MR used in stroke imaging in Washington and Kyoto

3.0T MR-OR fulfills aims in pediatric brain surgery

University of Vienna performs fiber tracking in the fetal brain

Achieva 7.0T put into action in Alzheimer's research in Leiden

MR in neuro

Clinical work and research by our users
Dear Friends,

Recently I took over the leadership of the Philips MRI business from Conrad Smits, who is now leading the Philips Ultrasound business. Previously I was the general manager for the Digital X-Ray business of the company. I began my healthcare career in MR, and bring 25 years of experience in medical device businesses in MR, CT, X-Ray, Patient Monitoring, Respiratory and Critical Care. In fact, this is my third time in MR. Customer engagement and collaboration stay a top priority of Philips MRI; ISMRM is a perfect opportunity to again enhance our relationship and to share our thoughts and innovations.

This issue of FieldStrength is dedicated to neuro imaging, and highlights the clinical and research work of our customers. Leiden University Medical Center, The Netherlands, is using the Achieva 7.0T for researching Alzheimer’s disease. In Alder Hey Hospital, UK, intraoperative MR imaging helps to optimize results of pediatric brain surgery. Medical University of Vienna is using fiber tracking in the fetal brain, and obtaining great results in this challenging area.

In addition, you can read how NeuRA, Sydney, Australia, is pushing the boundaries to achieve high-resolution fMRI. Fletcher Allen Health Care demonstrates how MultiTransmit contributes to improved image quality, consistency and speed in 3.0T spine imaging. And the Leuven University team made MR spectroscopic imaging fast enough to add it to routine exams.

The excellent work by these users underlines MRI’s leading role in neuro imaging. In collaboration with our customers we strive to further expand MR techniques for enhancing its use in current and new application areas.

Looking forward to a long and fruitful collaboration with you and seeing many of you at ISMRM.

Stephen Lorenc
SVP and General Manager BU Magnetic Resonance, Philips Healthcare

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MR-OR fulfills aims in pediatric brain surgery
Intraoperative Achieva 3.0T MR-OR helps in pediatric neurosurgery at Liverpool children’s hospital

Fast brain spectroscopic imaging fits routine clinical use
After speeding up spectroscopic imaging with SENSE, Leuven clinicians routinely use brain spectroscopy

Convert your ACS-NT or Intera 1.5T into Achieva 1.5T A-series

Optimizing DWI image quality in the brain
After speeding up spectroscopic imaging with SENSE, Leuven clinicians routinely use brain spectroscopy
ISMIRM 2011 highlights
Philips is changing expectations, with new products and opportunities to benefit patients

Imaging 2.0, introduced at RSNA 2010, is Philips’ new approach to clinical collaboration and integration, with patient focus, and optimized economic value to support radiologists in finding success in the new realities of practicing medicine. MR related examples of Philips’ advanced technology that are highlighted at the ISMRM meeting in Montreal include Ingenia 1.5T/3.0T, IntelliSpace Portal and Sonalleve MR-HIFU®.

Ingenia: the first-ever digital broadband MR system with dStream technology

Ingenia 3.0T and 1.5T are based on revolutionary dStream architecture, which captures the MR signal at the patient. Combined with enhanced workflow and ease of use, Ingenia increases SNR up to 40% and throughput up to 30%. The channel-independent system eliminates the need for major system upgrades, and the 70 cm wide bore system provides excellent quality and performance for large patients, with a FOV of up to 55 cm.

Ingenia 3.0T also includes MultiTransmit 4D to allow for optimized RF for acquiring real-time cardiac imaging.
IntelliSpace Portal for advanced multimodality review and collaboration
This thin-client applications server solution offers access anywhere, and scalable performance for different environments. It is designed to be the platform for advanced processing for Philips Healthcare. Collaboration tools are available at multiple locations connected to the customer enterprise. The IntelliSpace Portal offers packages for MRI applications like tumor tracking and cartilage assessment, and standalone perfusion and diffusion analysis.

Panorama HFO Oncology Configuration adds the excellent soft-tissue contrast of MR to support CT radiation treatment planning, for lesion visualization and target delineation. The 160 cm wide-open patient aperture in combination with the flat tabletop supports patient positioning. Whereas the spacious RF coils limit deformation to the patient’s body and provide imaging solutions for a range of applications: prostate, brain, head and neck, and more.

Sonalleve MR-HIFU* is now available for fibroid therapy and bone pain treatment applications. The Sonalleve MR-HIFU procedure involves volumetric heating by focused ultrasound waves with real-time MR feedback.

*Sonalleve MR-HIFU is not commercially available in North America

NetForum
www.philips.com/netforum

Visit the NetForum community for ISMRM abstracts related to dStream, more on Ingenia, for Panorama HFO Oncology Configuration in Oslo, and more.
Multiple modalities
National Institutes

Most acute stroke patients are imaged with MR first at the NINDS at NIH, but other modalities are needed as well.

The National Institute of Neurological Disorders and Stroke at the National Institutes of Health, (NINDS, NIH Washington, DC, USA) collaborates in acute stroke programs at two hospitals in the metro-DC area, Suburban Hospital and Washington Hospital Center. The majority of the patients examined here for stroke are having ischemic stroke. With a stroke team at both facilities, and priority emergency access to MR, most patients are imaged with MR first, unless contraindication exists.

“I believe MR leads to a more accurate, more prompt diagnosis of acute stroke, both acutely and for secondary prevention.”

Steven Warach, MD, PhD is senior investigator and chief of the Section on Stroke Diagnostics and Therapeutics at the National Institute of Neurological Disorders and Stroke at the NIH.

“In general, MR has an advantage over CT. One limitation for CT is the restricted slice coverage in perfusion imaging. But the big advantage of MR is DWI. We know the advantages of diffusion MR over non-contrast CT are that stroke can be seen earlier and it’s better for milder strokes. And, in fact, we’ve seen that the MR advantage held up even at later times and in more severe strokes.”

Dr. Steven Warach, MD, PhD, received his PhD in Psychology-Neuroscience from Michigan State University and his MD from Harvard Medical School. He led research efforts that pioneered the routine clinical use of diffusion and perfusion MRI in ischemic stroke, performed seminal studies defining the human ischemic penumbra with MRI and introduced innovative uses of MRI into stroke clinical trial design.

MR, CT, US have well-defined advantages in ischemic stroke

Steven Warach, MD, PhD is senior investigator and chief of the Section on Stroke Diagnostics and Therapeutics at the National Institute of Neurological Disorders and Stroke at the NIH.
Multiple modalities benefit stroke program at National Institutes of Health

Most acute stroke patients are imaged with MR first at the NINDS at NIH, but other modalities are needed as well.

In addition, early lesions and chronic lesions in stroke are both shown as hypoattenuation in CT, but in diffusion MR, early lesions are bright while chronic changes are darker than normal parenchyma. Since many stroke patients have had either prior strokes or chronic ischemic changes to the brain, picking up early, subtle signs of new stroke and distinguishing them from old lesions can be quite difficult with CT.

“If we are considering IV tissue Plasminogen Activator (tPA) therapy, we might use CT to help us make that decision very quickly,” he says. “But when the MR exam is within the tPA time window, a 15-minute exam is done to obtain diffusion weighted imaging (DWI) and trace ADC for potential ischemia; a gradient echo scan for visualizing microbleeds, hemorrhage, and thrombus; FLAIR for sub-acute and chronic infarction, leukoaraiosis; TOF-MRA of the Circle of Willis to visualize occlusion; and a contrast-enhanced scan for perfusion deficit, mismatch, and backup for FFE for blood.”

Examinations beyond the tPA time-window are more extended, he adds. “T2-weighted scan, and post-contrast T1 weighted and FLAIR scans are added to obtain more general neuroradiologic information. The total exam time then is 22 minutes.”

When given within 4.5 hours after the onset of stroke, tPA can significantly reduce the damage and disability from stroke.

When looking at vessels, CT angiography has an edge over MR angiography, says Dr. Warach. “MR has more potential artifacts. Using time of flight, if there is turbulent flow, that can overcall the degree of narrowing in an artery. If there is calcification at a branch point you may lose signal in MR but also CT may give artifacts there.”

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Acute ischemic stroke with diffusion-perfusion mismatch

A 57-year-old male presented to the hospital emergency room more than 5 hours after onset of aphasia and right-sided weakness. Acute hyperinsensity of focal ischemic brain injury on the diffusion image (left). Larger region of hypoperfusion on MTT (center) indicates a diffusion perfusion mismatch, the MRI marker of the ischemic penumbra. FFE shows acute thrombus (arrow) in M2 division of the left middle cerebral artery. Because the patient presented too late for standard iv tPA therapy, but had brain tissue at risk, evidenced by the diffusion-perfusion mismatch, he was taken to the interventional suite and was treated with intra-arterial thrombolysis and mechanical embolectomy.

As far as hemodynamic imaging methods, he says “MR has better whole brain coverage, and now we’re seeing clinically useful versions of Arterial Spin Labeling for MR without IV contrast. And there is, of course, the issue of radiation exposure in CT.”

Dr. Warach uses carotid Doppler or carotid duplex ultrasound in some patients as well. “In that small group who can’t get an MR because of contraindication, this can be very helpful.”

Hemorrhagic stroke

For acute hematoma in the brain, both MR and CT are equally good to assist in the detection and diagnosis of acute parenchymal hemorrhage. “But we often don’t know whether it’s a hemorrhage or ischemia,” says Dr. Warach, “so we prefer to just go straight to MR. If there’s a clinical suspicion of subarachnoid hemorrhage, I believe CT is highly accurate in that and used by most people for this.”

Also at issue is chronic hemorrhage. Dr. Warach explains, “Microbleeds or micro hemorrhages are not seen on CT but are seen on MR. There’s increasing literature suggesting that these identify both the risk of future hemorrhage and also a pathology called amyloid angiopathy, which puts the patient at high risk for recurrent brain hemorrhages. So those patients are a unique population, and the pathology is only seen on MR and not on CT.”

MR first choice at NIH

In Dr. Warach’s opinion, MR is the best overall imaging modality for acute stroke. “I believe that MR leads to a more accurate, more prompt diagnosis of acute stroke, both acutely and for secondary prevention. I think our patients are very well served by that.”

“We often don’t know whether it’s a hemorrhage or ischemia, so we prefer to just go straight to MR.”
Stroke care cycle shows potential growth for role of MR

Care cycle helps to analyze needs and guide improvements in stroke care

The stroke care cycle traces a patient’s pathway through care, across boundaries in the care system, from prevention and screening to secondary prevention and management of chronic disease.

“The care cycle approach helps us to detect and deeply understand unmet needs, and expand or improve our solutions,” says Frits van Krieken, PhD, Care Cycle Director of Cardiovascular Disease at Philips Healthcare. “We want to understand the medical process, and also the patient and care provider experiences. We try to avoid ‘jumping to solutions’ until we have validated our understanding.”

Care cycle analysis shows what can improve

“The care cycle aligns very well with Philips’ patient-centered approach,” Dr. van Krieken adds. “We look for improvements all through the care cycle, not just to strengthen links that are already strong.”

Philips is currently identifying phases of the stroke care cycle that can be improved. These include:

- Shortening of “discovery-to-needle” times
- Elimination of protocols that require knowing the time of stroke onset, which currently exclude patients who wake up having a stroke
- Giving more patients an opportunity to undergo mechanical clot removal or bleeding treatment in neuro-intervention cath labs
- Rehabilitation support so patients can practice therapies at times and places that are more convenient for them

Potentially increasing role for MR in stroke care cycle

Among clinicians there are different views on the role MR plays at the start of the cycle, in hyperacute diagnosis. Often CT is the preferred modality because it is more readily available and faster. However, MR provides more clinical information to the physician. In sub-acute and follow-up situations MR is a valuable tool to learn more about the stroke itself and assess complications.

“The value of MR after the acute phase has already been recognized, particularly to monitor the effect of treatment or to look for signs of complications,” says Dr. van Krieken. “In the future, MR may be used in the research for the assessment of stroke risk, focusing on carotid artery plaque burden and vulnerability.”

“The quality of MR studies is constantly improving, as is the speed of a complete stroke MR assessment,” says Dr. van Krieken. “I hope its role will expand to making better risk-benefit assessments for therapy, and to guide interventional approaches.”

Example of MRI in (post) acute stroke. Courtesy of University Hospitals Leuven.
MRI routinely used for stroke in Kyoto

Clinicians at Kyoto Prefectural University of Medicine use MR in acute and post-acute stroke patients

In Japan, MR systems are very accessible. Compared to for instance Canada and Netherlands, Japan has about five times the number of MR units per capita. At Kyoto Prefectural University of Medicine, the department of radiology performs between 20 and 30 MR exams on stroke patients each month using Intera 1.5T.

**Imaging in stroke patients**

“The use of MR in stroke is already mainstream in our institute,” says Kei Yamada, MD, PhD, Kyoto Prefectural University of Medicine, Department of Radiology. “MRI is very important for us as it can help visualize infarcts in an early stage and also offers additional valuable imaging.”

However, time is a concern: a CT scan takes us about five minutes, but an MR scan takes us at least 20 minutes. “In an emergency situation, it’s a big difference between five minutes and 20 minutes,” says Dr. Yamada.

“When a stroke patient arrives, the neurologist will usually call us to see if MR is available, and if the system is occupied when we get the call, the patient is given a CT scan first, then an MR scan if it’s deemed necessary, for instance when no hemorrhage is seen on CT after tPA administration,” says Dr. Yamada.

“We don’t know which type of stroke a patient has when he or she comes in. If it’s ischemic stroke, we will see a DWI abnormality. If it’s hemorrhagic we will see dark signal on T2* imaging. Both sequences are included in the scan protocol, so that we know which type of stroke it is.”
**Acute embolic brain infarction at the left middle cerebral artery (MCA) territory**

This 77-year-old woman was hospitalized for angina pectoris (AP). She was found to have sudden mental status decline with left hemiparesis. She underwent MRI approximately 2 hours after the onset of this event. MRA revealed occlusion of the left MCA at the horizontal portion, with hemodynamic compromise at the same territory. There was, however, no apparent abnormality on DWI. After successful thrombolysis, she showed remarkable normalization of the mean transit time (MTT), and only has a small infarction involving the white matter of left temporal lobe (lower column).

**Small lacunar infarction of the midbrain**

A 66-year-old man was admitted to the hospital because of recurrent visual problems. He first had two episodes of double vision that lasted for a few minutes, with complete recovery. The last episode did not subside, and therefore prompted medical attention. The MR examination at hyperacute stage does not reveal abnormality on FLAIR.

Thin-slice DWI (3 mm slices, 1 mm gap) depicts the small infarction more clearly than the conventional DWI (5 mm slices without gap). The thin slice method has twice the spatial resolution in the craniocaudal direction. This data set can also be used for fiber tracking.

“MRI is very important for us as it can visualize infarcts and in an early stage.”
DWI helps to see early stroke

In the acute phase, CT is useful to rule out the presence of hemorrhage. For stroke assessment, it's easier to see infarcts with MR diffusion-weighted imaging (DWI) – especially small ones – at the earliest stage. “With CT, or on MR FLAIR imaging, it takes us at least three to four hours after the event before we actually see something in the images. But with DWI, we can catch infarct already about 40 minutes after it occurred.”

“DWI visualizes water molecule diffusion in the brain,” Dr. Yamada explains. “In healthy brain tissue, the intracellular water molecules are actively moving. But when the brain shuts down by deprivation of blood, then the cells have an energy failure, and the gelatinous content of the cells will stop moving, leading to diffusion restriction, and that increases the signal on diffusion weighted images. So, with DWI we see abnormally high intensity of infarcted tissue, and this hyperintensity can already be caught as quickly as 40 minutes after the clogging of the vessel.”

MR exam offers more

In the acute phase, imaging is performed for secondary prevention, to identify the culprit lesion (between heart and brain), and to help treatment decision-making. Dr. Yamada says, “I prefer MR more often than CT because I prefer to avoid the radiation exposure, and also to obtain the MR angiography and hemodynamic information.”

“MR angiography is used for visualization of vessels, to determine whether they are blocked or not,” says Dr. Yamada. “Angiography can be done using CT as well but in CT angiography contrast agents are used, which is not necessary with MR. MR’s ability to do hemodynamic imaging is another advantage in using MR for stroke.”

MR is also used to assess how much of the brain is well-perfused. “This information helps us to decide whether the patient needs treatment or not,” says Dr. Yamada. Studies have also shown that MR tractography may be useful for this decision [4].

In follow-up, MRI is used as often as it is available, and CT scans are sometimes intermixed, depending upon availability. MR is also used to perform plaque imaging which is a potential cause of stroke.

Dr. Yamada believes that the role of MR will grow for use in stroke patients when they first arrive to the ED. “I think that currently, on a global scale, a CT scan is used most often, but in the next 10 years or so, I think we may be seeing a shift toward MRI.”

References


Small lacunar infarction of the internal capsule

A 52-year-old woman with sudden onset of right hemiparesis underwent an MR exam at hyperacute stage. The T2-weighted image shows a small hyperintense lesion at the left cerebral hemisphere. From this alone, it may be difficult to discern whether the internal capsule or thalamus is involved. The diffusion weighted image with superimposed sensory (green) and motor (purple) tracts reveals the lesion directly involving the left motor fibers, a finding well correlated with the patient’s motor symptoms.

The fiber tracking method using thin slice diffusion tensor imaging (DTI) data set is clinically feasible. Studies have shown the benefits of using tractography. Parallel imaging technique is considered indispensable when performing DTI for tractography.
Medical University of Vienna realizes advanced in utero fiber tracking

Fiber tracking performed in the fetal brain

The Medical University of Vienna (Austria) established its fetal MRI program in 1998 under the direction of Daniela Prayer, MD, now the head of its neuroradiology program. Collaborating with obstetricians all over Austria, the University has gained in both referrals and expertise, and now routinely performs fetal MR exams. Many of these include fiber tracking studies, according to Dr. Kasprian.
Gregor Kasprian, MD, department of Neuro and Musculoskeletal Radiology, says fiber tracking uses Diffusion Tensor Imaging (DTI) to measure the degree and directionality of water motion in certain tissue.

“The main difference in the fetal brain,” he says, “is that there is little or no myelin in most of the brain regions. We adapt our DTI sequence for the fetal brain and the unmyelinated tissue.”

Fetal fiber tracking yields valuable information
There are three types of cases in which fiber tracking is very useful, says Dr. Kasprian. One is so-called clastic lesions, such as acquired fetal brain lesions, infarction and parenchymal defects. “By characterizing the connections and trajectories of these structures, we can tell what functional deficits might be expected.”

“The second type of case is structural brain malformations, such as in fetuses where the corpus callosum is missing,” he says. “We can now visualize abnormally oriented fiber tracks, which helps us to further discriminate different types of brain malformations and give a more specific diagnosis.”

The last group is metabolic diseases. The mother usually compensates for these, but conditions such as white matter disorders may manifest in utero. “With this technique we can quantify the diffusion in the fetal brain, and decide whether it might be an issue of maturation, or whether it is abnormal,” Dr. Kasprian explains.

In utero DTI of lobar holoprosencephaly
After sonographic suspicion of a major fetal brain malformation, a young pregnant woman was referred for a fetal MRI exam at 33 gestational weeks. The figures show different commissural and projection pathways in a fetal brain with holoprosencephaly. The tractography results are projected onto coregistered axial T2 TSE images. Note the prominent anterior commissure (pink), the partially developed hippocampal commissure (blue), the corticospinal tracts (green) and frontopontine trajectories (yellow). DTI and tractography offer new insights into the connectivity of the malformed fetal brain in utero and in vivo, which will further help to characterize these pathologies in a more specific way.

The fetal MR exam was done on Intera 1.5T with the mother in supine position and using the 5-element SENSE Cardiac coil. The dedicated fetal neuroimaging exam includes multiplanar orthogonal T2-weighted scans and axial DTI with 16 encoding directions, b-values 0 and 700 s/mm², reconstructed voxel size 0.94 x 0.94 x 3 mm, acquired in 1:50 min.
Motion challenges can be overcome
The main challenge in fetal fiber tracking is motion, both fetal and maternal. Dr. Kasprian’s sequence takes about 90 seconds, and he generally doesn’t use sedation. “It helps if the head of the fetus is already in the lower pelvis, so motion is limited. If the head is in breech position, it is below the mother’s diaphragm and moves with the mother’s breathing.”

His approach is to limit acquisition time. “We use a DTI sequence with 16 gradient encoding directions, and a reconstructed voxel size of 0.94 x 0.94 x 3 mm,” he explains. “By using an asymmetric voxel size, acquired in an axial plane, we reduce the imaging time. We also use SENSE imaging, which contributes to a shorter acquisition time, and is very worthwhile in this technique.”

The results are well worth the extra efforts. “Fiber tracking gives us information we cannot get with any other imaging technique,” says Dr. Kasprian.

Dr. Kasprian uses Philips Achieva 1.5T with release 2.5 software and the 5-channel SENSE Cardiac coil. “We are really happy with the Philips system; it’s very user-friendly,” he says. “We can look at the very small structures of the fetal brain on the huge flat screen color monitor. So far, the most beautiful in utero DTI images that I’ve seen have come from Philips scanners.”

References


G Kasprian, G Amann, J Panotopoulos, F M Kainberger, D Prayer, I M Noebauer RSNA 2010, trainee research prize winner

Visit NetForum to watch a Web Seminar and more on fetal imaging. Use Search term fetal.
NeuRA Imaging Center uses Achieva 3.0T TX to perform high quality mapping of visual system

Neuroscience Research Australia (NeuRA, Sydney) installed their first 3.0T magnet in 2003. MR scanning at NeuRA focuses mainly on the brain, including mood and aging disorders, brain injuries and general neuroscience research. High resolution fMRI has become much faster and easier since NeuRA received its 32-channel SENSE Head coil.

“The 1.5 mm protocol has become our bread and butter fMRI protocol for retinotopic mapping.”

Mark Schira, PhD

High resolution anatomic mapping
High resolution T2-weighted scan (0.5 x 0.5 x 0.6 mm³) of a healthy volunteer. Purpose of this scan was to evaluate the level of quality achievable with the 32-channel SENSE Head coil. Note the fine detail in the cerebellum.

3D SPAIR multiplanar reconstructions
fMRI benefits from high resolution

Mark Schira, PhD, senior research officer at NeuRA, is using high-resolution fMRI to investigate the visual system, and perception in general. “We’re working on improving our techniques for retinotopic mapping and testing that our methods are valid,” he says. “In addition, we perform very high quality anatomical mapping of the brain, which would not be possible without the 32-channel coil.”

Dr. Schira’s high resolution fMRI looks at high detail organization of the visual cortex, showing how the different parts of the retina are mapped in the occipital lobes and how perception of contours is organized. The visual cortex is well understood in neurosciences, and Dr. Schira says, “It’s still the gold standard for fMRI in general, and it’s a very useful system to work with if you’re interested in fMRI.” Paradigms for retinotopic mapping typically use a flickering checkerboard pattern, not shown at the complete visual field but restricted to a small part of the screen such as a wedge (a pie-slice that rotates around the circle) or rings growing out from the center.

“We’re working on improving our techniques for retinotopic mapping. There’s a very tight control with respect to brain organization, and if a technique doesn’t quite work or has some issues, you will clearly see that because the data will not make any sense. The visual cortex is such a reliable system, it allows us to push the boundary and see whether we’ve been successful doing so.”

“We can see blood vessels in high resolution EPI scans. With typical EPI fMRI techniques using a 3 mm voxel resolution, we can’t see individual blood vessels, but beyond 1.5 mm, we can. High resolution fMRI is entirely necessary for that. The visualization of the blood vessels allows the researchers to make the distinction between ‘brain or vein.’ In other words, they can be sure that the BOLD signal response comes from the cortex and not from the down-stream venous system.”
The difference between 1.2 mm and 0.9 mm may not sound that impressive,” he adds, “but when comparing it to fMRI resolution that others routinely do, between 2 mm and 4 mm, the difference is stunning. That’s where the 32-channel coil has really added value to our work.”

“The high resolution was easily obtained with the combination of Achieva 3.0T TX and the 32-channel SENSE Head coil,” says Dr. Schira. “The flexibility of the EPI protocols was really good, and it was easier to get to these high resolutions than with other scanning systems. High resolution fMRI on the Achieva 3.0T TX is incredibly simple and straightforward.”

“The 32-channel coil has almost cut our scanning times into half.”

The foveal confluence is an area of overlapping cortical regions which has been thought particularly difficult to disentangle. “It’s possible to do high resolution fMRI work with the 8-channel coil. It gave us 1.2 mm resolution when we were really pushing the coil,” says Dr. Schira. “Now, with the 32-channel coil, we get to 0.9 x 0.9 x 0.9 mm resolution, mostly because of the increased SNR, especially in the superficial parts of the cortex.”

In addition to a remarkable 0.9 mm voxel size for fMRI, NeuRA’s researchers are not stopping in their quest for perfection. “We’re trying to improve the image quality of anatomical mapping, too. We have acquired 0.6 mm T2 and T1 datasets. I don’t think that would have been possible without the 32-channel head coil,” says Dr Schira.

“The difference between 1.2 mm and 0.9 mm may not sound that impressive,” he adds, “but when comparing it to fMRI resolution that others routinely do, between 2 mm and 4 mm, the difference is stunning. That’s where the 32-channel coil has really added value to our work.”

In the future, Dr. Schira hopes to see the availability of 3D EPI sequences. “This will allow us to use SENSE acceleration in more than one direction, to acquire multiple slices at the same time and have high resolution and larger coverage.”
MR-OR setup fulfills aims in pediatric brain surgery

Intraoperative Achieva 3.0T MR-OR helps to increase pediatric neurosurgical referrals to Liverpool children’s hospital in first year.

Since December 2009, Alder Hey Children’s Hospital, Liverpool, UK, has used an Achieva 3.0T MR-OR (dual-room setup of Achieva 3.0T suite and operating room) for intraoperative MRI (ioMR), mainly in brain tumor resection procedures. Dr. Mallucci estimates that the majority of the neuro work is pediatric brain tumors in the posterior fossa and supratentorial. The remaining work is resections for epilepsy. Because the MR system is in a separate room it can also be used for general diagnostic scanning.

“In a significant fraction of our tumor resection procedures, surgery was extended after the intraoperative MR exam.”

Dr. Conor Mallucci
MB, BS, FRCS (Surgical Neurology) is a Consultant Pediatric Neurosurgeon in the Department of Pediatric Neurosurgery at Alder Hey Children’s Hospital in Liverpool. He has just stepped down from chairing the British Pediatric Neurosurgery Group. He is deputy editor of the British Journal of Neurosurgery and associate editor of Child’s Nervous System.

Dr. Shivaram Avula
Consultant Pediatric Radiologist, Alder Hey Children’s Hospital NHS foundation Trust
“One reason for using MR-OR is because images used for surgical navigation lose accuracy during surgery due to brain shift and tissue removal, so an updated navigation volume scan is needed,” says Conor Mallucci, consultant neurosurgeon at the Alder Hey Children’s Hospital. “Secondly, to help you see if your surgical goal is achieved. Being able to see during surgery that resection is incomplete lessens the likelihood that a patient will need repeat surgery. Of the set of pediatric tumors we have data on, ioMR led to a significant fraction having extended surgery after their ioMR.”

**Combining MR-OR with normal OR conditions**

“Most people’s idea of MR-OR is of a large magnet that changes day-to-day working and prevents use of your normal equipment,” says Dr. Mallucci. “However, we have a dual-room setup with a MRI suite separated by doors from a normal operating room (OR) with plasma screen and navigation software. We use an MRI compatible head coil with frame and an operating tabletop that slides smoothly to a trolley to transport the patient to the MRI scanner. In addition, we have the possibility to view images and control the Achieva 3.0T from within the MRI room.”

Before surgery, the patient is already pre-set up with the MR coil. Disconnecting and moving the patient on the trolley through double doors into the adjacent MRI room can be done very fast. The patient is connected to an MR compatible anesthetic trolley. After scanning, the patient returns to the OR where – if necessary – the operation can continue with updated navigation scans.

“We now use a dedicated Noras coil with head holder where fiducial markers can help make the neuronavigation much more accurate,” explains Shivaram Avula, Consultant Pediatric Radiologist at Alder Hey. “During surgery one part of the coil is placed under the head and serves as the head holder. For intraoperative MR scanning, the top part is placed over the head. This coil offers better spatial resolution for targeting very small areas than the Flex-L coil that we initially used.”

**Diagnostic and intraoperative scanning**

Children under six need sedation for an MRI exam as they will not lie still. At a basic level, with an intraoperative scan, everything is done at one time. With specific preoperative sequences, an intraoperative scan and a postoperative scan all under the same anesthetic, it is one stop, one treatment, one service. The final intraoperative scan can usually serve as postoperative scan, so no further post-op exam is needed.

The preoperative study takes sometimes up to an hour, and can be done the day before the operation. It is done using the SENSE Head coil and includes a 3D T1 FFE sequence, T2 TSE in three planes and a coronal FLAIR sequence.

**User experiences**

**MR-OR of meningioma**

18-year-old girl with recurrence of known extra-cranial meningioma. Pre-operative coronal T2w images reveal the infratemporal tumor (white arrow). ioMR shows residual tumor (white arrow) within the sphenoid sinus which was subsequently excised. Note that the surgical cottonoid within the resection cavity (blue arrow) can mimic residual tumor. MR-OR helped to prevent the need for a second operation. Philips Achieva 3.0T R3.2 with 8-channel SENSE Head coil used for pre-operative imaging, SENSE Flex-L coil used for intraoperative imaging.
for intraoperative comparison. A dynamic susceptibility contrast (DSC) sequence is performed during contrast administration whenever possible.

An intraoperative scan to check neuro navigation is normally only a 3D T1-weighted scan to update the navigation data set. For a check on surgical goal, there is a pre-contrast sequence, a 3D T1W and the T2W in three planes. If it appears on the non-enhanced sequences that the entire tumor or the intended extent of tumor has been removed, the gadolinium contrast is administered and post-contrast imaging is done. These scans, together with coronal FLAIR and a Diffusion Tensor Imaging (DTI), also serve as the immediate postoperative exam.

MR scanner remains available for broader use
“Our setup provides us two rooms with independent function for most of the time, during which the MR scanner functions as an outpatient scanner, independent of OR theatre activity. The ITU (Intensive Therapy Unit) is close by so it is also convenient for in-patient examinations of these children,” says Dr. Avula.

MR-OR of pilocytic astrocytoma
A 10-year-old girl presented with a history of head ache for six weeks with evidence of papilloedema and cerebellar signs on clinical examination. A posterior fossa cystic tumor with an enhancing mural nodule is seen on the axial T2W TSE and contrast-enhanced T1 TFE images. ioMR reveals complete excision of the tumor on post-contrast T1 TFE, T2W TSE and FLAIR. In our experience, the FLAIR sequence is useful in ioMR evaluation of cystic tumors, as demonstrated here. With evidence of complete tumor resection, the IOMR study serves as the early postoperative MRI, which was traditionally performed 24–48 hours post tumor resection. A repeat early MRI scan (which in some cases requires general anesthesia) was not required.

Philips Achieva 3.0T R3.2 with 8-channel SENSE Head coil used for pre-operative imaging, SENSE Flex-L coil used for intraoperative imaging. T1 TFE with 1 mm isotropic voxels, T2 FLAIR with 1 mm in-plane resolution, T2W TSE with 0.6 x 0.7 mm resolution.

“With specific pre-op sequences, intra-op and post-op scans all under the same anesthetic, it is one stop, one treatment, one service.”
Apart from its intraoperative use, our Achieva 3.0T exams were general diagnostics in brain, musculoskeletal and some spine, he continues. “Compared with our Achieva 1.5T, the 3.0T field strength offers higher resolution neuro imaging, especially in epilepsy and other complex neurology. We can now provide a much better MRI service than before.”

**MR-OR, final thoughts**

Having the MRI suite and the OR theatre independently available is ideal for cost effectiveness, according to Dr. Mallucci. “From a patient efficiency perspective, we see MR-OR adds a time penalty of 1 to 1.5 hours. However, the clear benefit is that in cases where the MR-OR setup helps to visualize an incomplete resection, we can immediately address the issue using updated navigation data and thus avoid a second surgery. In addition the final ioMR replaces the postoperative MRI that we used to perform,” summarizes Dr. Mallucci.

**MR-OR of pilocytic astrocytoma**

A 15-year-old-boy presented with a 9 month history of intermittent dizzy spells and vomiting. Pre-operative 1.5T MRI reveals a solid/cystic enhancing tumor involving the left cerebellar tonsil. Limited ioMR showed residual tumor on T2W sequences (arrow). Resection was extended and the second ioMR shows complete resection. The 3 month follow-up scan reveals no evidence of residual/recurrent tumor on the T1 TFE post-contrast scan.

By choosing the best sequence to be performed at the start of the study, the ioMR scan can be limited to a few sequences if there is convincing evidence of residual tumor tissue. In this case the T2W image revealed residual tumor which was completely removed on re-exploration.

Pre-operative and follow-up exams on Achieva 1.5T with 8-channel SENSE Head coil. Intraoperative imaging with Achieva 3.0T and SENSE Flex-L coil.
Fast brain spectroscopic imaging fits routine clinical use

After speeding up spectroscopic imaging with SENSE, clinicians at Leuven routinely use brain spectroscopy

The Department of Radiology at University Hospitals Leuven (Belgium) performs some MR brain spectroscopy exams each week with Achieva 3.0T TX. It provides valuable information in cases such as metabolic and mitochondrial disorders, and offers information for differential diagnosis between recurrent brain tumor and brain tissue changes resulting from radio-, chemo- or immunotherapy, as well as assessment of abscesses.

Applying SENSE in two directions has allowed the Leuven team to dramatically shorten the scan time of MR spectroscopic imaging (MRSI) in the brain to about three and a half minutes without loss of spectral or spatial resolution, while maintaining sufficient SNR. “These shorter scan times make it practical to include MR spectroscopy in routine brain MR exams,” says Philippe Demaerel, MD, PhD. “It adds only 5-10 minutes to the patient’s exam and provides clinically relevant information. We now routinely use 2D MRSI, and also single-voxel MR spectroscopy in cases where quantification is important.” The advantage of 2D-MRSI over single-voxel data lies in the extra information of obtaining the spatial distribution of metabolites in the brain by acquiring a whole grid of spectra with similar clinically acceptable scan times.

Leuven speeds up spectroscopy with SENSE

“Using the 8-channel head coil we acquire a 2D SENSE-PRESS MRSI with a field of view of 16 x 16 cm², and a volume of interest of 8 x 8 x 1 cm³. A typical acquisition voxel is 1 x 1 cm², reconstructed to 0.5 x 0.5 cm², with slice thickness 1 cm. TR/TE is 2000/35 ms,” explains Uwe Himmelreich, PhD. “With SENSE factor 2.0 x 1.8 the scan time is reduced to 3:34 minutes.”

“Long TE spectroscopy is mainly used to assess changes in metabolite ratios NAA/Cho, NAA/Cr, and Cho/Cr. In addition, metabolites that indicate anaerobic metabolism (lactate) or are indicative for abscesses (acetate, succinate) can also be identified in long TE spectroscopy,” says Dr. Himmelreich. “Short TE spectroscopy is used for the assessment of lipids and other...”
“MR spectroscopy adds 5-10 minutes to the brain exam and provides clinically relevant information.”

**Lymphoma**

74-year-old with visual impairment. Ophthalmological examinations were normal. MR of the brain demonstrated a contrast-enhancing lesion in the left occipital lobe. Possible diagnosis is a primary brain tumor (glioblastoma or anaplastic astrocytoma), solitary metastasis or lymphoma. MR Spectroscopy showed extremely elevated choline (indicative for high cellularity), and remarkable lipid peaks (membrane breakdown and necrosis). NAA and Cho were not identifiable. These findings are suggestive of an intracranial lymphoma, rather than a high grade primary tumor or a metastasis. This is of particular interest, as the three entities require different therapeutic strategies.

Clinical Cases are provided by Sofie Van Cauter, MD, University Hospitals Leuven.
metabolite changes such as myoinositol, glutamate/glutamine (Glu/Gln) and other amino acids, but also for the assessment of NAA, choline (Cho) and total creatine (Cr+PCr) if time does not permit the acquisition of two MR spectra with different TE.

Dr. Demaerel adds, “The ability to look at these changes is extremely important, and could really make a difference in diagnosis. The availability of SENSE allows us to reduce the scan times of MRSI so that it can be easily added to standard exams.”
Glycine

Four-day-old neonate with intractable seizures. Transcranial ultrasound showed a hypoplasia of the corpus callosum. Blood and spinal fluid had slightly elevated glycine. Anatomical MR images confirmed the tic corpus callosum. No other structural anomalies are seen. Spectroscopy was performed with three different TEs (35 ms, 144 ms and 288 ms). In the short TE spectrum a clearly elevated peak is seen at 3.6 ppm, which corresponds to myoinositol and/or glycine. Myoinositol has a short T2 and is therefore not visible at longer TE’s. The peak is visible at TE 144 and TE 288 and can therefore be assigned to glycine. In physiological circumstances, glycine is present in non-detectable amounts in the human brain. Due to an inherent disorder in the glycine metabolism in this patient, glycine accumulates in the body. Excess glycine in the brain and the organs results in serious medical problems, including encephalopathy.
MultiTransmit helps improve SNR and CNR in spine imaging

University of Vermont uses Achieva 3.0T TX and finds boost in quality of spine images

The University of Vermont (Burlington, Vermont, USA) has been investigating how spine imaging at 3.0T benefits from MultiTransmit parallel RF transmission. Spines of healthy volunteers of all ages from in and around the University have been scanned using Achieva 3.0T TX, with very good results for image quality and speed.

“Having more rapid scan times without loss of SNR or CNR is really significant.”

Christopher Filippi, MD, is Director of Magnetic Resonance Imaging and Radiologist at Fletcher Allen Health Care, and Associate Professor at University of Vermont College of Medicine. Specializing in neuroradiology and radiology, Dr. Filippi’s areas of expertise are adult and pediatric neuroradiology, functional MRI and musculoskeletal MRI.

Christopher G. Filippi, MD, is the Tampas Green and Gold Professor of Radiology, Section Head of Neuroradiology, Director of MRI and Medical Director of the University of Vermont MRI Center for Biomedical Imaging. His study looks at overall image quality improvements with MultiTransmit in thoracic and lumbar spine MRI. He says consistently high image quality and improved SNR and CNR were the main reasons that adding MultiTransmit to their 3.0T system was so important.

“MultiTransmit was shown to help obtain consistently high image uniformity in our routine 3.0T body and breast imaging. We have also applied MultiTransmit for spine to see if it would improve image quality, and it does. MultiTransmit technology allows for RF shimming to correct B1 inhomogeneity, which makes for a better image.”

Images show vastly improved uniformity, SNR and CNR

“With MultiTransmit we have achieved better signal-to-noise and contrast-to-noise ratios (SNR and CNR) on every thoracic and lumbar spine sequence we’ve tested so far,” Dr. Filippi says. “RF shimming provides more flip angle uniformity across the FOV, so SAR is more uniformly distributed, and you get rid of areas of dielectric shading that occur often in routine spine imaging at 3.0T, where either the signal drops out or is too bright. In all the spine sequences we use, there are improvements with MultiTransmit.”

In a recent study, Dr. Filippi performed lumbar axial and sagittal T1 scans with ten volunteers as well as axial and sagittal lumbar T2 scans with another nine volunteers. He found that — in addition to better uniformity – CNR and SNR increase considerably. “It depends upon the sequence, but for sagittal T1, CNR was up 53% and SNR was up 19%; for axial T1, CNR improvement was 48% and SNR was 23%; for sagittal T2, CNR was 38% better and SNR was 20%; and for axial T2, CNR was 18% better and SNR was fully 100% better. Obviously, this represents improved image quality for all people we’ve scanned so far.”
MultiTransmit helps improve SNR and CNR in spine imaging. University of Vermont uses Achieva 3.0T TX and finds boost in quality of spine images.

“MultiTransmit or parallel transmission MR really provides much faster scan times and better image quality.”

**Focal disc herniation**
2D axial T2-weighted TSE without and with MultiTransmit in thoracic spine of 21-year-old male. The scan without MultiTransmit is undiagnostic. Achieva 3.0T TX, 15-channel SENSE Spine coil. In-plane resolution 0.47 mm x 0.47 mm, 24 slices of 4 mm thickness, FOV 150 mm, scan time 3:33 min.

**Lumbar spine**
2D axial T2-weighted TSE without and with MultiTransmit in 47-year-old male. With MultiTransmit the nerve roots are well visualized, while without MultiTransmit these could not be confidently visualized and the scan is undiagnostic. Achieva 3.0T TX, 15-channel SENSE Spine coil. In-plane resolution 0.47 mm x 0.47 mm, 24 slices of 4 mm thickness, FOV 150 mm, scan time 3:33 min.
The fact that we have significantly better SNR and CNR sort of mandates the use of MultiTransmit. It’s just a better way to image.

MultiTransmit also speeds up spine exams

Although he was focusing on image quality, Dr. Filippi has certainly noticed speed improvements. “We see faster scan times with MultiTransmit, especially on axial images. When using the MultiTransmit parallel transmission and RF shimming, we can essentially do more axial slices per given TR. We can better control SAR, and thus scan faster in the axial plane. We’ve had 40% reductions in that scan time.”

Clinical benefits

The clinical benefits of the higher image quality provided by MultiTransmit are significant. “Traditional spine image quality at 3.0T is fraught with a greater degree of artifactual loss of signal, particularly in the lumbo-sacral junction, conus medullaris, and thoraco-lumbar junction. Now, MultiTransmit provides improvements in CNR and SNR that improve quality of these types of scans at 3.0T.”

In the MultiTransmit lower thoracic spine images Dr. Filippi evaluated, he saw several disc herniations that might otherwise have been missed. “With routine imaging, you may not have seen these herniations, but with MultiTransmit there was a clear herniation that was easier to detect.”

“MultiTransmit also allows scanning patients much more quickly, which is important because many are in pain and they don’t tolerate imaging well,” he adds.

With better image quality and shorter scans, is 3.0T the future of spine imaging? “Absolutely, MultiTransmit or parallel transmission MR really provides much faster scan times and better image quality,” says Dr. Filippi. “The door is open to starting using it as well in other exciting areas like DTI of the spinal cord in the thoracic and conus regions. Having more rapid scan times without loss of SNR or CNR is really significant.”

Future research will include MultiTransmit

The next phase of Dr. Filippi’s study is to determine whether MultiTransmit helps improve lesion conspicuity and detection. “In addition, we’d like to focus on continuing our earlier research on DTI of the conus region in adults and we plan to focus on the tethered spinal cord in children. Regardless of what happens next in our research, the fact that we have significantly better SNR and CNR sort of mandates the use of MultiTransmit. It’s just a better way to image.”

References

CG Filippi, Grand Isle, JM Johnson, M Carlson, HN Burbank, GF Alsofrom, T Andrews Improvement in Lumbar Spine MR Imaging at 3.0T with the Use of Parallel Transmission (MultiTransmit) MR RSNA 2010 abstract
Patient history
55-year-old male patient with ankylosing spondylitis (AS) was evaluated because of suspected TIA. The patient reported an episode of blurred vision and dizziness. The clinical question was, if there was any evidence of ischemia in the brain, or any evidence of atherosclerosis in the aortic arch or carotid arteries. In addition evaluation of the cervical spine was requested because of the AS.

MR examination
Ingenia 1.5T with dStream HeadSpine coil solution with tiltable head section was used to provide easier positioning and more comfort for kyphosis patients.
Results of the study
No focal abnormalities in the brain parenchyma on any of the sequences including the diffusion images. In the cervical spine multiple fused vertebrae are seen. The MRA was unremarkable and did not show any stenosis or plaque.

Carotid ultrasound (not shown) confirmed MRA findings.

Impact of using Ingenia
MR imaging in patients with ankylosing spondylitis can be challenging because of difficulties with patient positioning and subsequent motion artifacts due to patient discomfort.

In a traditional MR system this patient could not be supported in a comfortable position. However, the Ingenia’s wide bore and the ability to angulate the coil helped the patient to successfully undergo the study.

In addition, note the lack of signal drop-off at the lower limit of the aortic arch due to the superb architecture of the new dStream HeadSpine coil solution.

The dStream HeadSpine coil can be tilted up to 20 degrees.
Achieva 7.0T put into action in Alzheimer’s disease research

Mark van Buchem, MD, PhD, is professor and chief of neuroradiology at the Department of Radiology and head of the Neuroimaging Research Group at the Leiden University Medical Center (LUMC). He completed his residency program in Radiology at the LUMC. He was a research fellow at Neuroradiology Section of the University of Pennsylvania Medical Center in Philadelphia and a visiting professor at Harvard Medical School. His research interests include the ageing brain, cerebral lupus erythematosus and migraine.
The consortium is financed by the Center for Translational Molecular Medicine, a Netherlands-based public-private partnership dedicated to the development of new medical technologies. The aim is to develop within a specific time frame a technique or combination of techniques that will facilitate early diagnosis of Alzheimer’s disease and allow us to see at the molecular level how the disease develops. As well as LUMC, the consortium includes three other academic partners and several industrial partners, the largest being Philips Healthcare.

“Here at LUMC we’re concentrating on MRI, but others in the consortium are developing new PET techniques to detect proteins, techniques for analyzing cerebrospinal fluid, and new psychological tests,” says Professor van Buchem.

Visualizing amyloid plaque with MRI

Much of the research at LUMC is based on what’s known as the ‘amyloid cascade hypothesis’. One of the histological hallmarks of Alzheimer’s disease is the presence of amyloid plaques in brain parenchyma. According to the amyloid cascade hypothesis, these plaques play a central role in the cause of the neurodegenerative changes in the brain that give rise to cognitive loss, and finally dementia. Since it’s believed that amyloid plaques accumulate in the brain more than a decade before the first symptoms occur, it’s thought that detecting amyloid plaques in vivo may open up possibilities for early diagnosis of the disease.

With its exceptionally high SNR, 7.0T MR is used in research on Alzheimer’s disease

The key to developing effective treatments for Alzheimer’s disease is early diagnosis. Mark van Buchem, MD, PhD, Professor of Neuroradiology at Leiden University Medical Center (LUMC), heads a consortium researching new possibilities in this area. The LUMC research focuses on using their Philips’ Achieva 7.0T research system to visualize amyloid accumulation.
PET using the experimental “Pittsburgh compound B” (PiB) is already proving to be a promising technique for visualizing amyloid plaque, but PET is relatively expensive and not widely available to the general population since the technique requires special equipment such as a cyclotron to generate the short-lived isotopes used to label PiB. The alternative approach currently being investigated at LUMC involves visualizing amyloid plaque using ultra-high-field MRI.

“We already know from studies on small animals that amyloid plaques are associated with iron which is visible on susceptibility weighted ultra-high-field MR imaging,” points out Professor van Buchem. “The question now is whether this is also possible with people.”

According to Professor van Buchem, this requires use of an ultra-high field MR system like the Achieva 7.0T. This high field strength offers more than twice the SNR of 3.0T, which can be traded for spatial resolution to allow visualization of amyloid protein concentrations in the brain. “The Achieva 7.0T system is one of the most powerful MR systems available,” he says. “The design is also very patient friendly for a research system, with soft lines and a room arrangement that looks like any regular MR suite.”

LUMC has been one of Philips’ leading centers for clinical work since as long ago as 1983 when it became the first medical center in the world to install a Philips MRI scanner. “In general I have to say that we’re very enthusiastic about the system and our collaboration with Philips. We particularly like the 7.0T user network created by Philips to connect researchers working with the system and allow them to share ideas and experiences. This, as much as the excellent performance of the system, was an important factor affecting our choice for the Achieva 7.0T.”

“The Achieva 7.0T research system is one of the most powerful MR systems”
We particularly like the 7.0T user network created by Philips to connect researchers working with the system.

New molecular imaging techniques
As well as investigating the possibilities for directly visualizing amyloid plaque, the LUMC research group is also working on new molecular imaging techniques, including the development of special contrast agents for MRI that target amyloid plaque in the brain. “This may lead to a technique similar to the Pittsburg compound B PET technique. The challenge here is that with standard field strengths the sensitivity of MRI is several orders of magnitude lower than PET which means we really need to move to higher field strengths to achieve the sensitivity required for detecting local accumulations of molecules. Here too, the results with the Achieva 7.0T system are proving highly encouraging,” remarks Professor van Buchem. “What’s more, the big advantage of MRI compared with PET is that as well as information about amyloid proteins, you can get a lot of other information as well in just one examination, including information about the structure and metabolism of the brain.”

Combined sequences provide a fuller picture
The group at LUMC is working with several categories of volunteers including older but healthy volunteers i.e. people with no indications of Alzheimer’s disease, patients with mild cognitive impairment such as memory problems, young volunteers to investigate ageing effects, migraine patients and patients with Huntington’s disease.

“The most useful sequences for our research are T2*-weighted sequences from which we can generate phase images and susceptibility-weighted images. T2*-weighted sequences are particularly sensitive to iron accumulation in the brain, especially at 7.0T,” explains Professor van Buchem. “This is useful not only for visualizing amyloid plaque, but potentially for detecting a whole range of physiological conditions in the brain associated with iron accumulation. This proves the intrinsic value of 7.0T for research.”

To provide a fuller picture, the T2* weighted sequences are also combined with local spectroscopy using a new FLAIR sequence developed at University Medical Center Utrecht.

Future outlook
“The first steps in our research are aimed at developing a sensitive and specific technique that will help us to learn more about Alzheimer’s disease and provide a method for early diagnosis. We’re still at the initial stages here but the results with the 7.0T system are certainly positive,” concludes Professor van Buchem. “We then have to make sure that we have something to offer patients in the form of treatment. Once these conditions have been met, we can we look into the possibilities for broader use of MRI in early diagnosis of Alzheimer’s disease.”

“Healthy volunteer at 7.0T”
Images of a healthy young volunteer (age between 20-30 years) obtained with Achieva 7.0T.
Optimizing DWI image quality in the brain

Diffusion weighted imaging (DWI) has become an important methodology that is used in many types of examinations. The protocols of release 3.2 reflect the latest enhancements on Philips 1.5T and 3.0T scanners to help obtain the best possible brain DWI image quality.

These tips address SPIR fat suppression at 3.0T and how to enhance image quality by not using HalfScan and by selecting the appropriate SENSE factor. These settings are already part of any routine Philips DWI protocol at release 3.2 or higher.

TIP 1

Switch off HalfScan

In DWI imaging of the brain a fat rim may sometimes be seen in the images. The intensity of this residual fat signal is stronger at very short TE values. One way to lower the residual fat signal is to switch off HalfScan resulting in longer TEs. Note that this increase in TE will not hamper image quality or diffusion via other mechanisms. In addition, images without HalfScan are sharper and susceptibility effects are smaller.

Note the effect on fat suppression.
Using SENSE reduces susceptibility-related artifacts. A higher SENSE factor (about 3) provides good DWI image quality in the upper brain area. However, a higher SENSE factor also reduces TE, as a result of which some residual fat may be seen near the skull base. So, when the skull base is the area of interest, use of a lower SENSE factor is recommended.

For brain DWI at 3.0T changing the frequency offset of the SPIR pulse to 220 may further help, see the example below.
Check out the new NetForum online community

Visit www.philips.com/netforum

NetForum now offers completely redesigned navigation. Instead of having separate sections per modality, you now find your content organized in three sections:

**Explore** to share clinical results (Case studies, Best practices, Web seminars)

**Operate** to support your scanning (ExamCards, Application tips, Training)

**Grow** to support your business (Utilization dashboard)

New NetForum homepage.
Tips from the MRI NetForum team:

There is a growing amount of content related to Ingenia and dStream. Use either of these two keywords in the Search NetForum field (in the top right area of the page).

Check out the latest Web Seminars: recorded presentations by our expert users. You will find Web Seminars on clinical topics in the Explore section, and on business performance in the Grow section.

Are you looking for What's new on NetForum for MRI? Click View all in the Latest contributions shortlist on the Explore, Operate or Grow homepages. Then filter on MRI if you don’t want to see the other modalities.
Exciting news for ACS-NT or Intera 1.5T users

Now you can convert your system into full Achieva 1.5T A-series performance without having to change your magnet

Do you have an ACS-NT or Intera 1.5T system and would you like to expand your MRI capabilities or patient throughput? Our Conversion to Achieva program is a smart, simple and cost-effective way. System compatibility will be determined by our service team on site.

**What will this Conversion bring you?**

**High performance:** the converted system offers Achieva 1.5T A-series performance, and access to all Achieva 1.5T coils, software and options of your choice.

**Cost effectiveness:** apart from not spending your money on a new magnet, you save on construction work associated with magnet replacement.

**Easy installation:** as there will be no magnet replacement, the conversion work will be easy and limited to the MRI room, not impacting the rest of your facility.

**Green solution:** by keeping the current magnet you save virtually up to 40 tons of CO₂ and 13,000 kWh of energy. The revolutionary PowerSave smart energy management system will additionally save you up to 50% on MRI operational energy consumption.

Also check out: [www.philips.com/MRIconversion](http://www.philips.com/MRIconversion)

The conversion to Achieva is part of our SmartPath solutions. [www.philips.com/SmartPath](http://www.philips.com/SmartPath)

**T2w TSE** 0:47 min. 
**Voxels 1.0 x 1.3 x 5 mm**  
**Intera 1.5T with quadrature Head coil**

**T2 FLAIR TSE** 1:12 min. 
**Voxels 1.0 x 1.3 x 5 mm**

**T2w TSE** 0:39 min. 
**Voxels 0.9 x 1.1 x 5 mm**

**T2 FLAIR TSE** 1:12 min. 
**Voxels 0.9 x 1.2 x 5 mm**  
**Achieva 1.5T with 8-channel SENSE Head coil**
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Breast MR

European Workshop on MRI-guided vacuum Breast biopsies
Bruges, Belgium
Dates: May 26-27; October 6-7; November 17-18
European Workshop for radiologists with experience in breast imaging. Organized by Dr. Casselman, AZ St. Jan.
Info: jbenecke@mammotome.com

Advanced Breast MRI Workshop
Cleveland, OH, USA
Dates: October 4-6*
*Dates subject to change
2.5-day course for radiologists and technologists with basic understanding of breast imaging. Course includes didactic, hands-on and clinical reviews. Breast biopsy and post processing packages will also be covered.
Info: kara.grey@philips.com

Cardiac MR

Cardiac MR courses at CMR Academy
German Heart Institute, Berlin
All courses are for cardiologists and radiologists. Some parts will be offered in separate groups.
Info: www.cmracademy.com
Email: info@cmracademy.com
Phone: +49-30-4502 6280

Complete course
Dates: Part 1: October 24 – December 2
Intensive course including hands-on training at the German Heart Institute, and reading and partially quantifying over 250 cases.

Compact course
Dates: September 5-9
October 24-28
CMR diagnostics in theory and practice, including performing examinations and case interpretation.

CVMRI Practicum: New Techniques and Better Outcomes
St. Luke’s Episcopal Hospital, Houston, TX, USA
Date: October 10-13
On principles and practical applications of Cardiac MRI.
Info: ddees@sleh.com and lvillareal@sleh.com

Clinical Workshop on Cardiac MR stress perfusion imaging
London, United Kingdom
Date: September 21-23
Provided by radiologists and cardiologists. Includes hands-on CMR stress perfusion training. Course content will be adapted to meet the individual needs of the participants on every level. Limited number of participants (max. 10).
Info: www.cvti.org.uk
Email: admin@cvti.org.uk and enquiries@cvti.org.uk,
Phone: +44-207-3777000

MR Spectroscopy

MR Spectroscopy course
Zurich, Switzerland
Date: July 4-8
Theory sessions and daily practical scanning and post-processing sessions in small groups.
Info: http://www.biomed.ee.ethz.ch/education/education-centre/spectroscopy-course; dmeier@ethz.ch

Advanced MR Spectroscopy
Cleveland, OH, USA
Date: t.b.a.
MR engineers, research technologists, physicians, and physicists of Philips MR sites, interested in MR spectroscopy. Participants require basic MR scanning experience. Note that class size for this course is limited
Info: vicki.milligan@philips.com

Hands-on technologist CMR training
St. Louis, MO, USA
Date: Offered bi-monthly, by appointment
Info: http://ctrain.wustl.edu/ClinicalResearch/TechTraining2.aspx
Phone: +1-314-454-7459
Fax: +1-314-454-7490

European Course on Cardiovascular Magnetic Resonance
Munich, Germany
Date: June 2-4
Info: www.cmrcourse.de
Email: cmr-course2011@medconvent.at
Phone: +43-676-4984151

Musculoskeletal MR

Erasmus course on MRI: Musculoskeletal II
Izmir, Turkey
Date: September 12-16
Info: www.emricourseizmir2011.org
secretariat@emricourseizmir2011.org

Current issues of MRI in orthopaedics and sports medicine
San Francisco, CA, USA
Date: August 28-31
Info: www.stollerscourse.com

MR Spectroscopy

MR Spectroscopy course
Zurich, Switzerland
Date: July 4-8
Theory sessions and daily practical scanning and post-processing sessions in small groups.
Info: http://www.biomed.ee.ethz.ch/education/education-centre/spectroscopy-course; dmeier@ethz.ch

Advanced MR Spectroscopy
Cleveland, OH, USA
Date: t.b.a.
MR engineers, research technologists, physicians, and physicists of Philips MR sites, interested in MR spectroscopy. Participants require basic MR scanning experience. Note that class size for this course is limited
Info: vicki.milligan@philips.com

Calendars

Register on NetForum to have free access to online training modules on use of Philips MR scanners and packages, use of coils, use of EWS, MR safety.
General MR

Essential Guide to Philips in MRI
Cheltenham, UK
Dates: November 28 – December 1
Designed for Philips users. Includes 2 days on basics of MR physics and 2 days on advanced concepts. The course can be attended for 2-4 days.
Info: education@cobalthealth.co.uk

Philips North America off-site training courses

Dates: upon request
Info: kara.grey@philips.com
Phone: +1-440-483-5355
Fax: +1-440-483-7946

Events calendar 2011

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>More information</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 7-13</td>
<td>International Society for Magnetic Resonance in Medicine – ISMRM</td>
<td>Montreal, Canada</td>
<td><a href="http://www.ismmr.org">www.ismmr.org</a></td>
</tr>
<tr>
<td>May 16-19</td>
<td>Saudi Medicare</td>
<td>Riyadh, Saudi</td>
<td><a href="http://www.saudi-medicare.com">www.saudi-medicare.com</a></td>
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<tr>
<td>May 21-24</td>
<td>European Society of GastroIntestinal and Abdominal Radiology - ESGAR</td>
<td>Venice, Italy</td>
<td><a href="http://www.esgar.org">www.esgar.org</a></td>
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<tr>
<td>June 1-4</td>
<td>Deutschen Röntgenkongress – Röko</td>
<td>Berlin, Germany</td>
<td><a href="http://www.roentgenkongress.de">www.roentgenkongress.de</a></td>
</tr>
<tr>
<td>June 6-8</td>
<td>UK radiological Congress – UKRC</td>
<td>Manchester, UK</td>
<td><a href="http://www.ukrc.org.uk">www.ukrc.org.uk</a></td>
</tr>
<tr>
<td>June 3-7</td>
<td>American Society of Clinical Oncology – ASCO</td>
<td>Chicago, IL, USA</td>
<td>chicago2011.asco.org</td>
</tr>
<tr>
<td>June 23-26</td>
<td>Clinical Society of Magnetic Resonance – CMRS</td>
<td>Orlando FL, USA</td>
<td>cmrs.com</td>
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<tr>
<td>June 26-29</td>
<td>Annual Meeting Human Brain Mapping – OHBM</td>
<td>Quebec City, Canada</td>
<td><a href="http://www.humanbrainmapping.org">www.humanbrainmapping.org</a></td>
</tr>
<tr>
<td>July 1-7</td>
<td>Joint Spine Symposium: ESNR – ASSR</td>
<td>Barcelona, Spain</td>
<td>spineinternational.org</td>
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<tr>
<td>July 31-Aug 4</td>
<td>American Association of Physicists in Medecine – AAPM</td>
<td>Vancouver, Canada</td>
<td>aapm.org/meetings/2011AM</td>
</tr>
<tr>
<td>Sept 22-25</td>
<td>European Society of Neuroradiology &amp; Advanced Course - ESNR</td>
<td>Antwerp, Belgium</td>
<td><a href="http://www.esnr.org/">www.esnr.org/</a></td>
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<tr>
<td>Sept 26-28</td>
<td>Magnetic Resonance Angiography – MRA Club</td>
<td>Calgary, Canada</td>
<td>mraclub.com</td>
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<tr>
<td>Oct 7-11</td>
<td>American Society of Head and Neck Radiology – ASHNR</td>
<td>San Diego, CA, USA</td>
<td><a href="http://www.ashnr.org">www.ashnr.org</a></td>
</tr>
<tr>
<td>Oct 6-8</td>
<td>European Society for Magnetic Resonance in Medicine and Biology – ESMRMB</td>
<td>Leipzig, Germany</td>
<td><a href="http://www.esmmrb.org">www.esmmrb.org</a></td>
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<tr>
<td>Oct 2-6</td>
<td>American Society for Therapeutic Radiology and Oncology – ASTRO</td>
<td>Miami, FL, USA</td>
<td><a href="http://www.astro.org">www.astro.org</a></td>
</tr>
<tr>
<td>Nov 27 – Dec 2</td>
<td>Radiological Society of North America – RSNA</td>
<td>Chicago, IL, USA</td>
<td><a href="http://www.rsna.org">www.rsna.org</a></td>
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</table>
The first-ever digital broadband MR is changing expectations, and lives. That’s the power of Philips Imaging 2.0.

Thanks to Philips Imaging 2.0, a revolutionary imaging approach, the Philips Ingenia 1.5T and 3.0T MR systems set a new standard in clarity, speed and expandability. Ingenia captures and digitizes the signal closest to the patient to improve SNR by up to 40%. Easier coil handling and improved patient comfort help increase productivity by up to 30%. And, Ingenia is designed to meet the growing needs in oncology imaging. Discover the revolution in MR technology at www.philips.com/Ingenia30T.