TOMORROW TODAY

AIR Technology™

A collection of articles from SIGNA™ Pulse of MR

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AIR Technology™ Coils set to drive the future of MR imaging

"Flexibility or nothing" was the inspiration that guided GE Healthcare engineers as they set out to completely rethink traditional MR coils. There was no doubt there were limitations with the existing technology. Elements had to be placed a certain way within the coils, and coils were typically heavy, inflexible and bulky. The goal was to develop coils that were light, versatile and more pleasing to patients and technologists.

Rethinking coils was no easy task. After two dedicated research projects, engineers created the innovative technologies at the heart of GE Healthcare's revolutionary AIR Technology™‡ Coil Suite. Incorporating a miniaturized module of electronics and a flexible loop of linked resonators, these coils are at least 38% lighter than traditional coils plus the anterior array coil has the industry's highest channel count. They're also flexible and wrap closely around the patient like a blanket for incredible comfort and image quality. The result was simply better.

AIR Technology™ is also designed to work with other GE innovations like AIR Touch™ and AIRx™. AIR Touch™, an intelligent coil localization and selection tool, works as a bridge between the coil and the scanner. This allows the technologist to landmark the patient with a single touch, and even optimizes the element configuration based on the patient's size and shape. AIRx™, an AI-based, automated workflow tool for MR brain scanning, can be used with AIR Technology™ Coils to speed workflow by automatically prescribing slices to help reduce redundant manual steps.

To illustrate just how revolutionary AIR Technology™ is for patients, technologists and physicians, we've compiled a series of articles for you. You'll read about how these comforting and comfortable coils are being used to elevate the imaging experience for patients, improve image quality in all types of scans and transform technologist workflow. After reading, you'll be asking yourself what else can AIR Technology™ do? Quite frankly, we can't think of anything it can't do.

‡Not available for sale in all regions.

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The Queen Silvia Children's Hospital
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Transforming the MR imaging experience for one of Sweden's largest pediatric hospitals

As part of a modernization project, The Queen Silvia Children's Hospital upgraded to the SIGNA™ Architect with AIR Technology™‡. An initial evaluation by the Department of Pediatric Radiology found the new AIR Technology™ Anterior Array (AA) delivers good SNR and homogeneity for high-resolution imaging. The coil also enables flexibility and ease of positioning patients, and when used with AIR Touch™ makes coil selection easier and helps with workflow.

As one of the largest pediatric hospitals in Sweden, The Queen Silvia Children's Hospital at Sahlgrenska University Hospital in Gothenburg provides care to children from newborns up to age 18. The Department of Pediatric Radiology performs around 45,000 exams each year. Named for the country's current Queen, the hospital has undergone a modernization project to improve workflow and enhance clinical services as well as create a safe and secure healing environment for its young patients.

The pediatric radiology department recently upgraded its Discovery™ MR750w 3.0T wide-bore system to SIGNA™ Architect. With new gradients and Total Digital Imaging (TDI), the cutting-edge platform is designed to help facilities like The Queen Silvia Children's Hospital adapt to existing and future advancements in MR imaging technologies, such as AIR Technology™ and the SIGNA™ Works productivity platform.

"We want to be on the front line of new technology and prepare for the future," says Håkan Boström, MD, pediatric radiologist at The Queen Silvia Children's Hospital.

In addition to the recently upgraded SIGNA™ Architect, the hospital also has an Optima™ MR450w 1.5T. Combined, these two MR systems enable the hospital to perform more than 2,000 MR exams each year.

According to Pär-Arne Svensson, MR research radiographer, a key motivation behind the SIGNA™ Architect upgrade was the ability to acquire the new AIR Technology™ Suite, including the 48-channel Head Coil, along with new MR sequences available in SIGNA™ Works, specifically MUSE, PROPELLER MB (multi-blade), MPRAGE and distortion correction with diffusion-weighted imaging (DWI) like PROGRES.

The radiology department has been evaluating MUSE as a replacement sequence for single-shot diffusion imaging in neonates. With MUSE, Dr. Boström can obtain higher resolution and the distortion correction is better with less distortion artifacts. In addition

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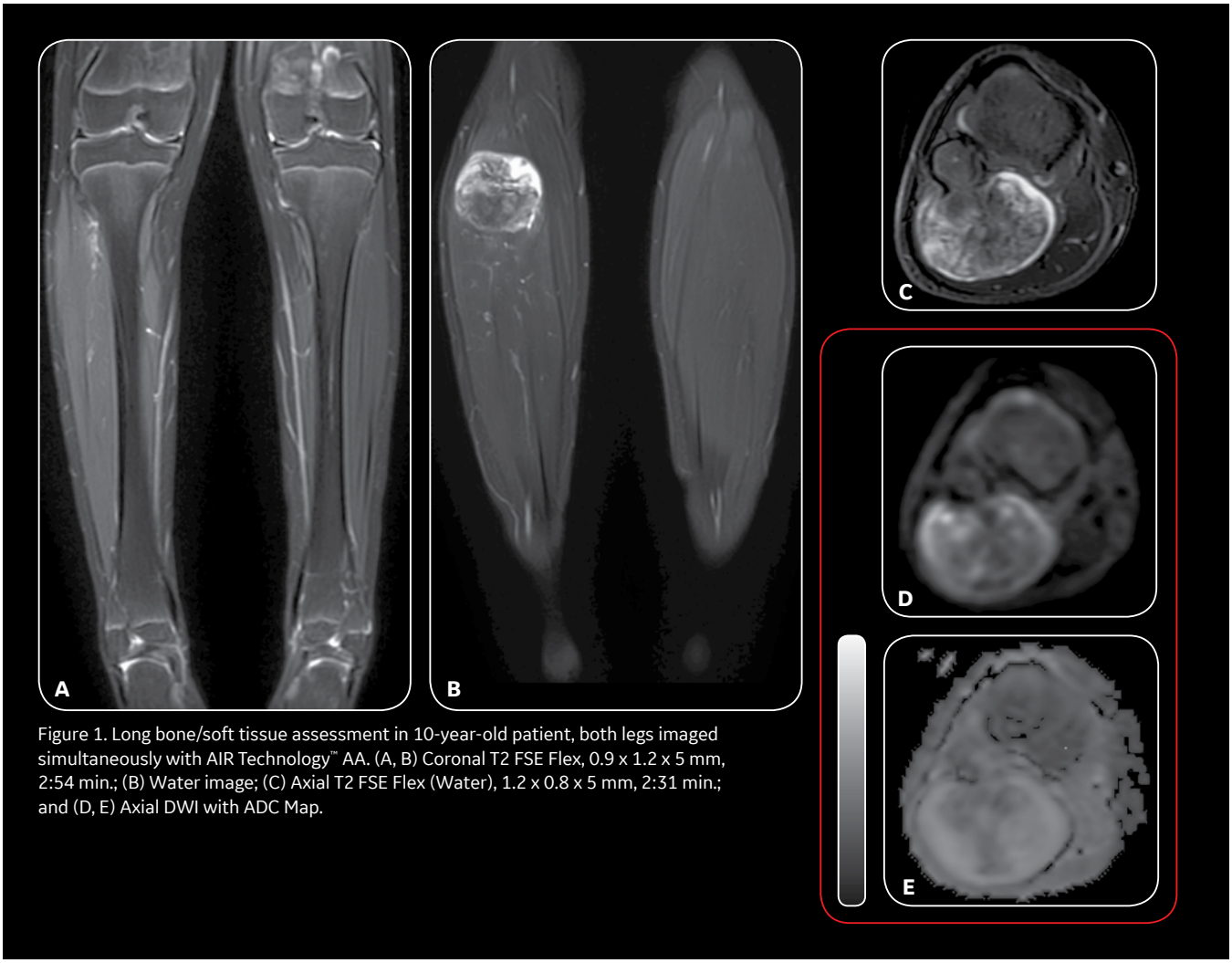

Figure 1. Long bone/soft tissue assessment in 10-year-old patient, both legs imaged simultaneously with AIR Technology™ AA. (A, B) Coronal T2 FSE Flex, 0.9 x 1.2 x 5 mm, 2:54 min.; (B) Water image; (C) Axial T2 FSE Flex (Water), 1.2 x 0.8 x 5 mm, 2:31 min.; and (D, E) Axial DWI with ADC Map.

to Dr. Boström finding that MUSE delivers high resolution and excellent image quality, PROPELLER MB is also helpful in avoiding metal artifacts. PROPELLER MB is particularly beneficial when imaging the cervical spine and temporal bone with diffusion sequences. Svensson and Dr. Boström are still evaluating MPRAGE, however, they are obtaining better contrast between white and gray matter in the brain compared to other conventional 3D FSPGR sequences. This sequence would be particularly helpful when imaging epilepsy patients before and after surgery.

In addition to the new sequences, the department received the AIR Technology™ AA and 48-channel Head Coil in early 2019. The AIR Technology™ AA has the highest channel count and coverage in the industry.

"Our initial experience is very good," says Dr. Boström. "We've used the AA for several exams, such as the abdomen, pelvic, lower extremities, shoulder and fetal imaging. The main advantages with the AIR Technology™ AA are the flexibility and ease of positioning on the patient."

It is lightweight—60 percent lighter than conventional, hard-shell coils—and children in pain may not tolerate a heavy coil on their body, Dr. Boström explains. This includes children who had open heart surgery at The Queen Silvia Children's Hospital, one of only two pediatric cardiac surgery centers in Sweden.

"Fetal imaging is another area where we see an advantage with the AIR Technology™ AA," adds Svensson. "It can be difficult to put a conventional, hard-shell coil around a pregnant woman's abdomen and get a good, homogeneous signal."

For women in the late stage of pregnancy, lying on their back can be uncomfortable. Svensson wants to try imaging them on their side with the AIR Technology™ AA wrapped around them and see what the impact is on patient comfort and image quality.

In musculoskeletal imaging of the shoulder and arm, lower extremities or imaging both legs, Svensson can wrap the coil around larger field-of-views (FOVs) and obtain a homogenous signal

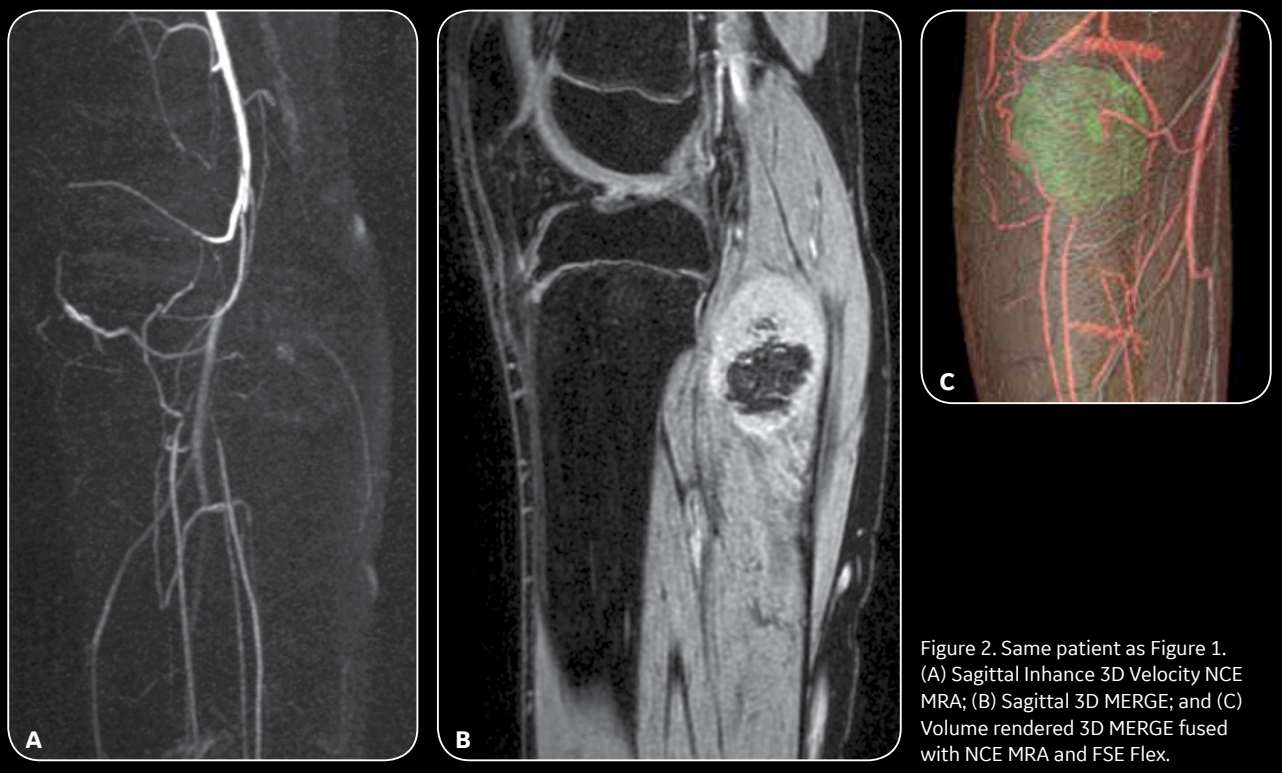

Figure 2. Same patient as Figure 1. (A) Sagittal Inhance 3D Velocity NCE MRA; (B) Sagittal 3D MERGE; and (C) Volume rendered 3D MERGE fused with NCE MRA and FSE Flex.

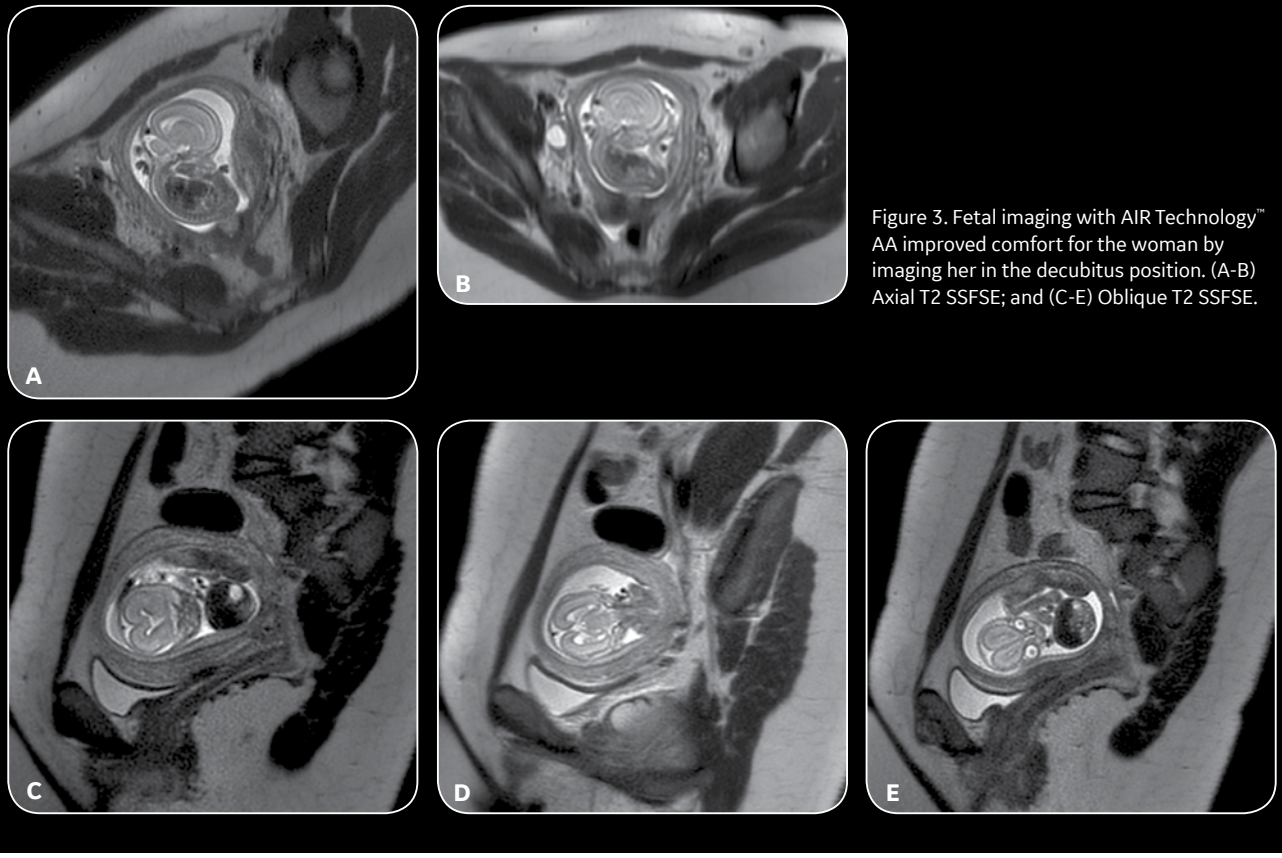

Figure 3. Fetal imaging with AIR Technology™ AA improved comfort for the woman by imaging her in the decubitus position. (A-B) Axial T2 SSFSE; and (C-E) Oblique T2 SSFSE.

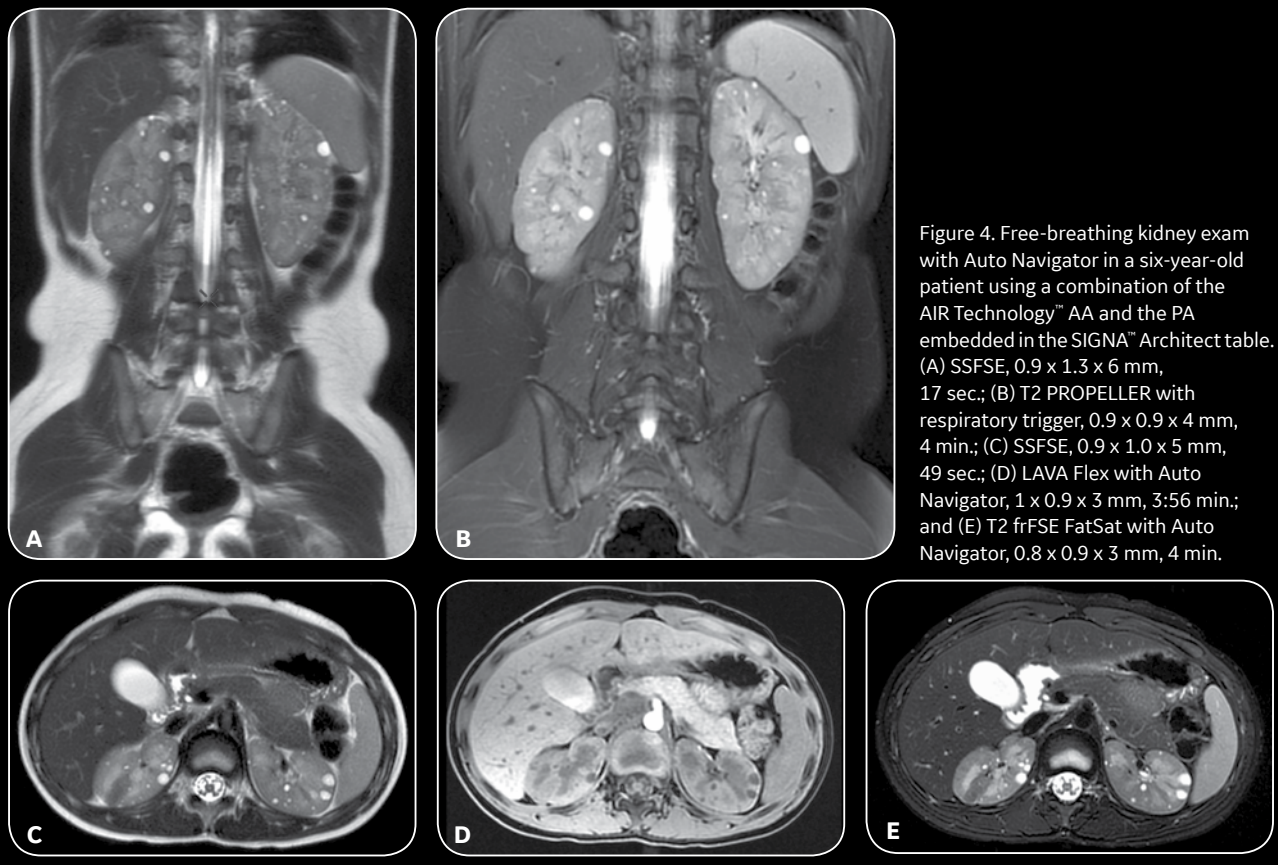

Figure 4. Free-breathing kidney exam with Auto Navigator in a six-year-old patient using a combination of the AIR Technology™ AA and the PA embedded in the SIGNA™ Architect table. (A) SSFSE, 0.9 x 1.3 x 6 mm, 17 sec.; (B) T2 PROPELLER with respiratory trigger, 0.9 x 0.9 x 4 mm, 4 min.; (C) SSFSE, 0.9 x 1.0 x 5 mm, 49 sec.; (D) LAVA Flex with Auto Navigator, 1 x 0.9 x 3 mm, 3:56 min.; and (E) T2 frFSE FatSat with Auto Navigator, 0.8 x 0.9 x 3 mm, 4 min.

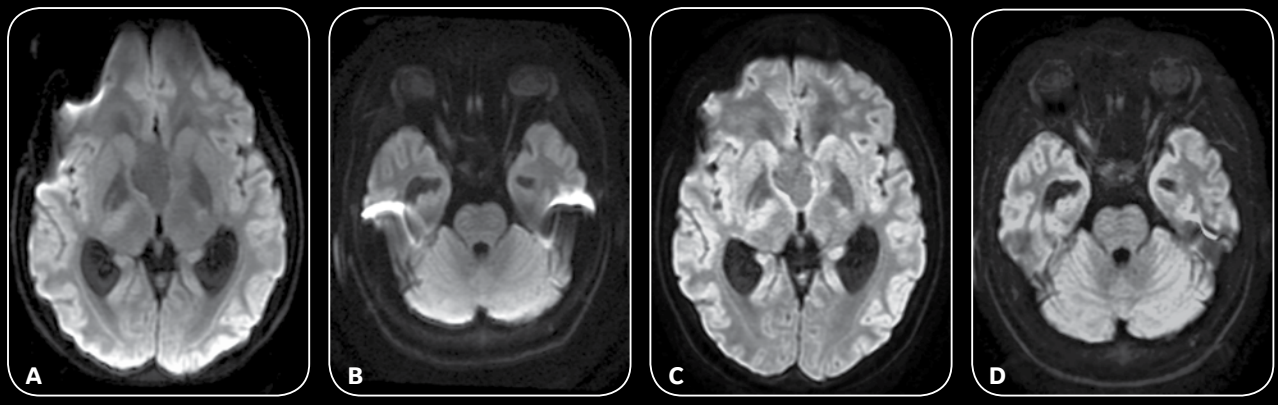

Figure 5. Neuro imaging with the 48-channel Head Coil in a three-year-old patient. Note the same resolution with less blurring in the MUSE DWI sequence. (A-B) Traditional single-shot DWI, 1.8 x 1.4 x 3.6 mm, 2 shots, acceleration factor of 2, 1:58 min.; and (C, D) MUSE DWI, 1.8 x 1.4 x 3.6 mm, 2 shots, acceleration factor of 2, 2:16 min.

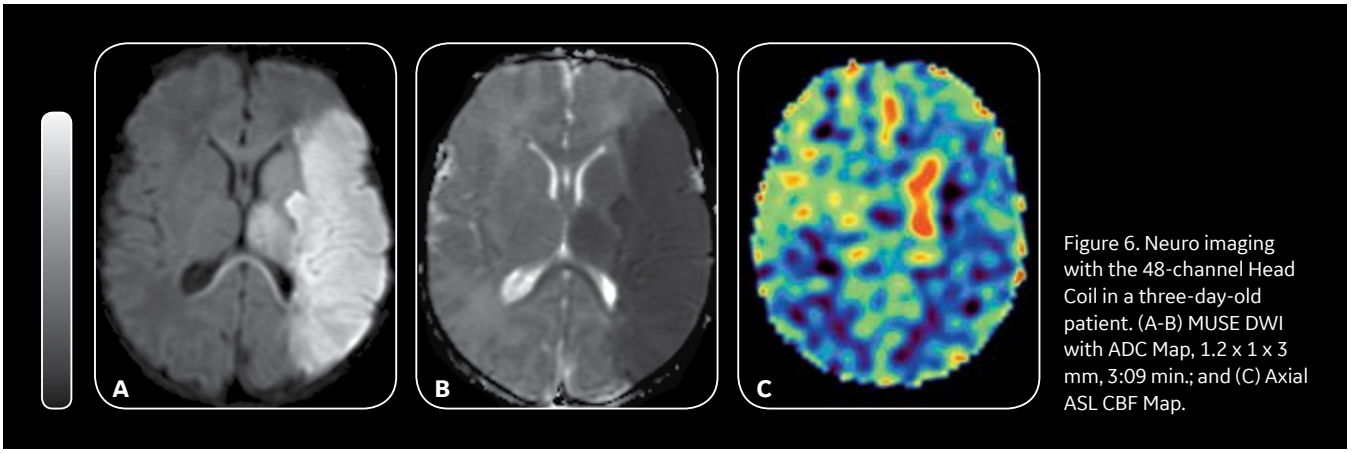

Figure 6. Neuro imaging with the 48-channel Head Coil in a three-day-old patient. (A-B) MUSE DWI with ADC Map, 1.2 x 1 x 3 mm, 3:09 min.; and (C) Axial ASL CBF Map.

for good image quality. For example, patients with multifocal chronic osteomyelitis or muscular dystrophy/myositis will often require imaging of both legs simultaneously.

"With the AIR Technology™ AA, we can cover large areas but we also get good SNR, so we can provide detailed images of specific joints with high resolution," he says.

Positioning these precious patients is also easier now with AIR Technology™. There are many factors that can impact the overall time a child is in the MR scanner and any time saved in positioning means the sooner the patient can get back to his or her parents.

Another patient-centric feature of AIR Touch™ is that it assists with patient positioning. It automatically selects the best elements to use and uniquely optimizes uniformity, SNR, artifacts and parallel imaging.

"AIR Touch™ makes coil selection much easier and I don't have to check what elements are activated because the system does it. It helps with workflow, but the most important factor is that it helps me focus more on the child."

Pär-Arne Svensson

AIR Touch™ even helps when using more than one coil. Embedded in the SIGNA Architect™ table is the Posterior Array (PA). With small children, Dr. Boström and Svensson are using GE's Flex Coil in combination with the PA. They have seen excellent results using the combination of both coils in cardiac and abdominal exams.

After using the impressive AIR Technology™ AA for just two months Svensson and Dr. Boström no longer use the conventional AA. They look forward to receiving the new AIR Technology™ Multi-Purpose (MP) Coil‡‡, a smaller version of the AIR Technology™ AA.

There have been a few patients who had MR exams with both the conventional coil and the AIR Technology™ AA. Svensson says when asked, these patients preferred the new coil, especially because it was not so heavy and confining on their bodies.

"The most important benefit of AIR Technology™ is the patient comfort," says Dr. Boström. "It is lightweight and can lay on the patient like a blanket. We believe this also impacts patient compliance."

Overall, Dr. Boström and Svensson are impressed with SIGNA™ Architect, SIGNA™ Works and especially AIR Technology™.

"This is a stable MR system with very good image quality," says Svensson. "We are satisfied with the upgrade and our initial experience with AIR Technology™."

‡‡Not CE marked. Not available for sale in all regions.

Takafumi Naka, RT(R)(MR)
Kawasaki Saiwai Hospital
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Ultra-flexible AIR Technology Suite making a difference in the technologist's workflow

The AIR Technology™‡ Suite simplifies patient positioning and setup with AIR Touch™ automatic coil and element selection, a 60 percent lighter design than prior generations of coil technology and a flexible design that fits patients of various sizes and shapes.

Kawasaki Saiwai Hospital in Kanagawa, Japan, installed the SIGNA™ Architect 3.0T MR system in late 2017. In February 2019, the hospital upgraded to the latest version of the SIGNA™Works productivity platform and acquired the AIR Technology™ Suite. As one of the main healthcare providers for the region, especially for acutely ill patients, the hospital embraces the concept of patient-centered healthcare. The AIR Technology™ Anterior Array (AA) conforms to the human body, is flexible to fit all shapes and sizes and has a 60 percent lighter design compared to previous generations of conventional coil technology—making it the ideal coil to deliver both patient comfort and high image quality at Kawasaki Saiwai Hospital.

Takafumi Naka, RT(R)(MR), Chief Technologist, evaluated the new system and coils and the impact on the technologist's workflow and patient experience. He was most impressed that the AIR Technology™ AA is ultra-flexible and can be wrapped around the patient to facilitate positioning and fits a variety of patient body sizes.

In musculoskeletal (MSK) extremity imaging, coil selection for MR exams of the humerus and antebrachial bone would require two coils to image from the shoulder to the elbow. The AIR Technology™ AA, however, covers a larger region of interest (ROI) with a comfortable wrap-around fit and a higher SNR. Naka expects the same results in lower extremity imaging, particularly for patients with cellulitis and muscle contusions where large ROIs need to be acquired.

A conventional heavy, hard-shell coil on a patient's chest could impact the respiratory detection device, so Naka would place a spacer between the coil and the patient.

"However, with the AIR Technology™ AA, we no longer have to do that," Naka says. "We now have better patient positioning workflow and also get an improvement in SNR because the coil is closer to the patient's chest."

In addition, he does not have to worry about setting the coil center because AIR Touch™ automatically detects it, providing additional workflow improvements and removing the chance for human error.

Naka is also thrilled that he can use higher parallel imaging acceleration factors with the AIR Technology™ AA. In one case, he applied a factor of 4x for a body Coronal DWI and had less distortion and blurring than with a conventional coil (Figure 1).

"It was a single-shot EPI DWI, however, the anatomy detail and information was really amazing," he adds.

Naka has also used higher parallel imaging acceleration factors in body PROPELLER exams. He leveraged this capability for better image quality, such as refocusing the flip angle for higher T2 contrast. He sees the same impact

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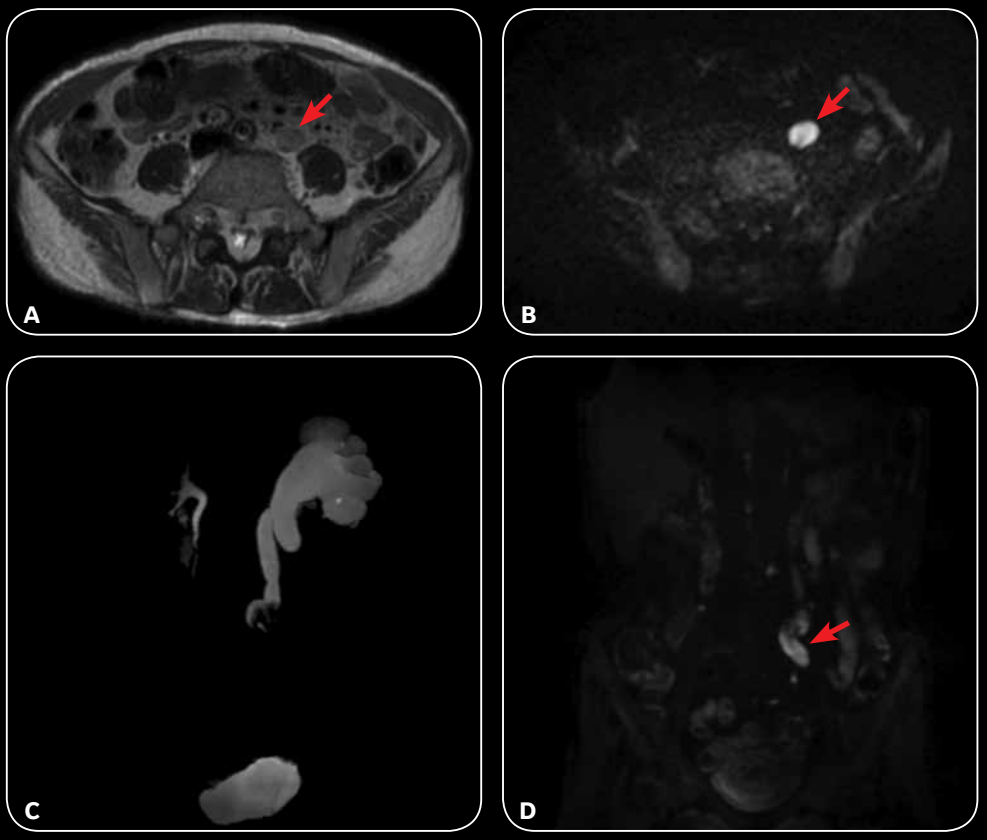

Figure 1. High-resolution MR Urography with reduced scan time is possible using HyperSense and HyperCube. A urethral tumor was visualized on the Coronal DWI using long axis. Even with an ASSET factor of 4.0, there was low distortion in the diffusion-weighted images. All images acquired with the AIR Technology™ AA. (A) Axial T2w SSFSE, 1.3 x 1.4 x 4 mm, 1:28 min.; (B) Axial DWI b1000, 2.7 x 2.7 x 4 mm, 3:57 min.; (C) MR urography, 0.7 x 1.2 x 1.4 mm, 2:40 min. (RTr); and (D) Coronal DWI b800, 3.1 x 1.6 x 4.5 mm, ASSET factor 4, 4:27 min. (RTr).

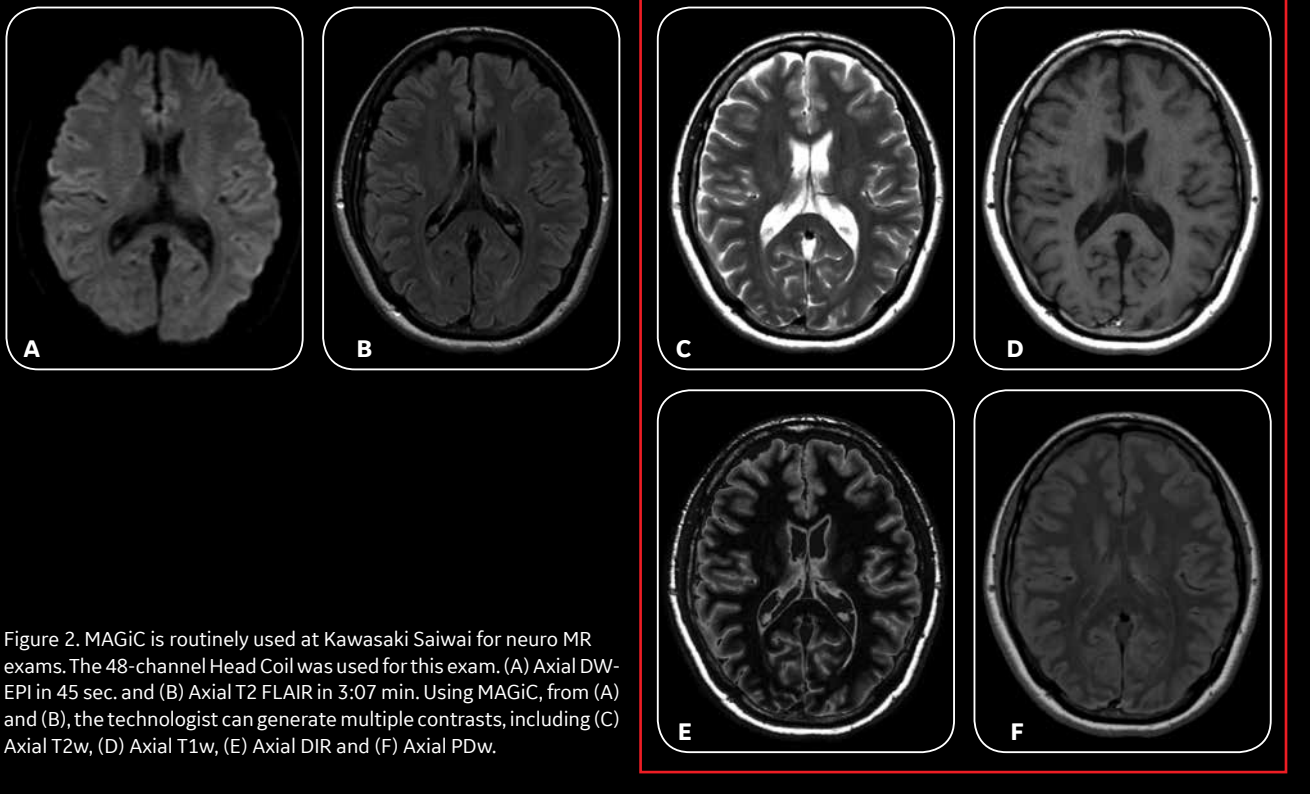

Figure 2. MAGiC is routinely used at Kawasaki Saiwai for neuro MR exams. The 48-channel Head Coil was used for this exam. (A) Axial DW-EPI in 45 sec. and (B) Axial T2 FLAIR in 3:07 min. Using MAGiC, from (A) and (B), the technologist can generate multiple contrasts, including (C) Axial T2w, (D) Axial T1w, (E) Axial DIR and (F) Axial PDw.

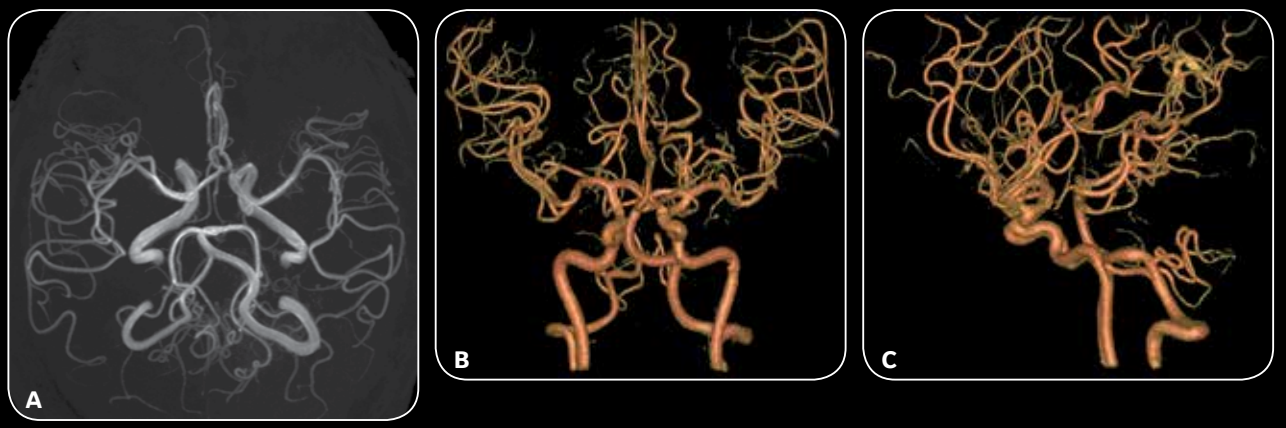

Figure 3. (A-C) TOF MRA with HyperSense factor of 2.5 and ARC factor of 2, 0.4 x 0.5 x 0.8 mm, 6:06 min.

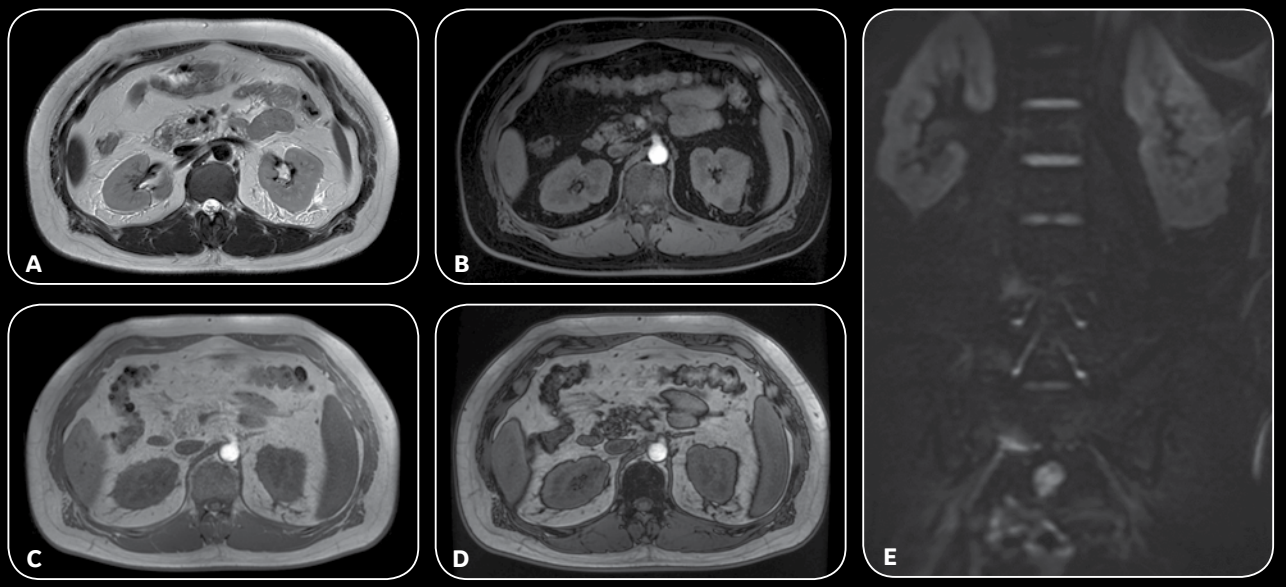

Figure 4. Patient weighed over 200 lbs. (120 kg). Abdominal kidney exam using the AIR Technology™ AA required a wide FOV, however, highly uniform images were acquired. (A) Axial T2w PROPELLER MB, 0.8 x 0.8 x 5 mm, ASSET 4.0, 5:39 min.; (B-D) Axial LAVA Flex; (B) water; (C) in-phase; (D) out-of-phase: 1.6 x 1.6 x 4 mm, 14 sec.; and (E) Coronal DWI b900, 3.1 x 1.6 x 5 mm, ASSET 4.0, 4:20 min.

in neuro imaging with the 48-channel Head Coil.

"We already use MAGiC in clinical routine neuro examinations to acquire excellent T1 contrast, which by principle is difficult to obtain at 3.0T," Naka says. "However, with the 48-channel Head Coil, we can reduce the scan time from six to three minutes because of the higher SNR," (Figure 2).

Plus, the 48-channel Head Coil allows Naka to use a higher HyperSense factor because of the high SNR and spatial resolution. As a result, he can now acquire a high-resolution MR angiography exam in six minutes—something that previously took approximately 20 minutes (Figure 3).

He has noticed that patients are more relaxed with the AIR Technology™ AA than with conventional coils. Even large-sized patients weighing over 200 lbs. can fit comfortably inside the MR, with space between the coil and the bore (Figure 4).

Kawasaki Saiwai Hospital also installed the latest version of the SIGNA™Works productivity platform with SIGNA™ Architect. Naka loves the improvements in DWI, especially MUlti-plexed Sensitivity Encoding technique (MUSE) and PROGRES.

"The most impressive application is MUSE, a multi-shot DWI that allows us to achieve quite high spatial resolution compared to conventional DWI," he explains. "I find that MUSE DWI provides us completely different image quality versus the conventional sequence."

In particular, the improvement in female pelvis imaging is notable. MUSE DWI clearly depicts details of cervix and

Figure 5. MUSE acquires high resolution DWI even at high b-values (b1000) and by using 4 shots with ARC acceleration of 1, distortion can be reduced. Fusing Sagittal T2w PROPELLER MB with the ADC map does not lead to distortion even in the presence of rectal gas. (A) Sagittal MUSE b1000, 1.5 x 0.9 x 6 mm, 4 shots with ARC acceleration of 1, 5 NEX, 4:39 min.; (B) Sagittal T2w PROPELLER MB, 0.8 x 0.8 x 6 mm, 4:12 min.; and (C) Fused ADC map with Sagittal T2w PROPELLER MB.

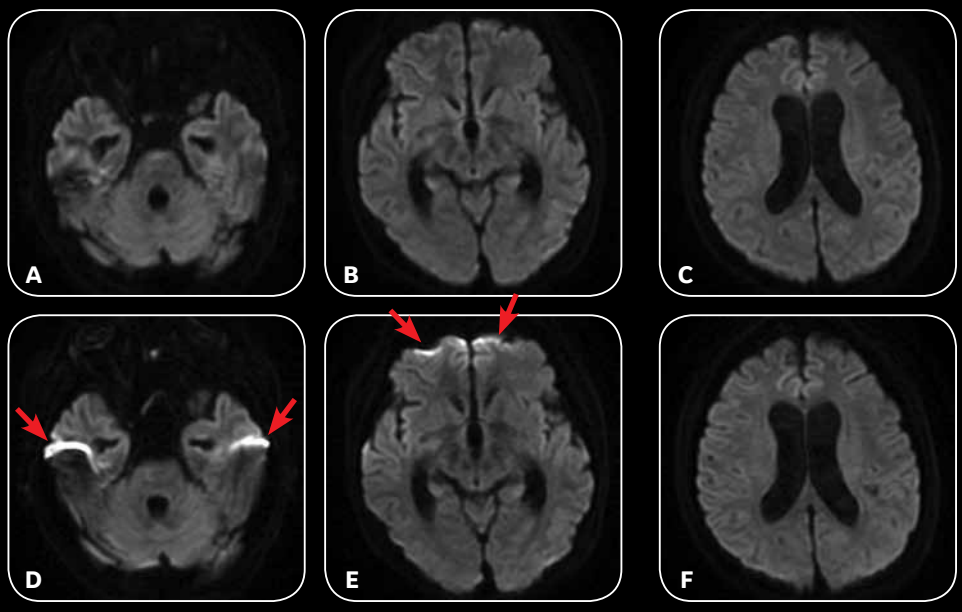

Figure 6. (A-C) DWI with PROGRES; and (D-F) conventional DWI. PROGRES provides less distortion than conventional DWI sequences, including fewer susceptibility artifacts (arrows) around the eye and inner ear.

endometrial lesions when Naka sets the acquisition plane (slices) along the uterine axis (Figure 5).

"We could see almost no distortion even in the Sagittal plane and there was less artifact from rectal gas," explains Naka. "Surprisingly, when we fuse MUSE DWI with T2-weighted images, we could not find misregistration caused by distortion. So, we think high-resolution MUSE DWI will have an advantage in detecting small lesions in the pancreas."

After investigating several sequences, Naka and his colleagues found PROGRES provided the best DWI image with the least distortion. Susceptibility artifacts around the eye and inner ear were decreased with no major impact on scan time when using PROGRES. As a result, PROGRES is being frequently used for neuro DWI at Kawasaki Saiwai Hospital (Figure 6).

From streamlined patient positioning to greater patient comfort, Naka sees the difference that AIR Technology™ has on the patient experience. For his department, the ability to use higher acceleration factors and save time in patient set-up will positively impact the technologist's workflow, further improving staff satisfaction. And, with the new sequences available in SIGNA™ Works, he and his team can deliver the excellent image quality clinicians need for a more confident diagnosis.

Masatoshi Hori, MD, PhD
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An upgrade that meets the expectation for higher resolution, SNR and productivity

After upgrading its SIGNA™ Architect to the latest SIGNA™Works productivity platform and acquiring the AIR Technology™‡ Anterior Array (AA), Osaka University Hospital is delivering exceptional MR imaging that also promotes patient-centered care—two tenets of the hospital's core philosophy. The combination of these three advanced technologies is delivering excellent image uniformity across a wide range of patients and clinical exams.

For nearly 150 years, Osaka University Hospital (originally Osaka Medical School, circa 1869) has served the residents of Osaka and fostered the education of medical professionals throughout the region. The hospital's dedication to providing high-quality medical care is centered on the belief that adopting new and advanced technologies further promotes patient-centered, safe and reliable holistic care that contributes to the society.

"At Osaka University Hospital, we always seek the latest innovative technology to provide the best clinical performance and patient care," says Masatoshi Hori, MD, PhD, Associate Professor, Department of Radiology at Osaka University Hospital. With this philosophy, the department recently upgraded its existing Discovery™ MR750w 3.0T to SIGNA™ Architect and also acquired the AIR Technology™ AA.

"Our key expectation for MR is higher resolution, higher signal-to-noise ratio and higher temporal resolution," Professor Hori says. "This upgrade completely meets our expectations."

He found the AIR Technology™ AA to be lighter than expected and anticipates it will provide a better patient experience during an MR exam. Technologists have also shared with him that patient and coil set-up is much easier and that SNR gains are being realized because, in most cases, the coil fits the many shapes and sizes of patients much better than conventional arrays.

"The AIR Technology™ AA is one of the biggest innovations I have seen in the last decade," adds Professor Hori. He believes it will become a future standard technology and is excited to be an early adopter.

An important benefit of AIR Technology™ is the ability to utilize higher parallel imaging acceleration factors with the coil element configuration and lower g-factor of the new coils. Specifically, in a 640 x 640 matrix T2-weighted PROPELLER Multi-shot Blade (MB) FatSat pancreas exam, high-resolution images were obtained with an ARC factor of 4 in 4:24 minutes (Figure 1).

PROPELLER MB is one key enhancement that Professor Hori is routinely using. It combines multiple blades together to achieve shorter TEs and improved

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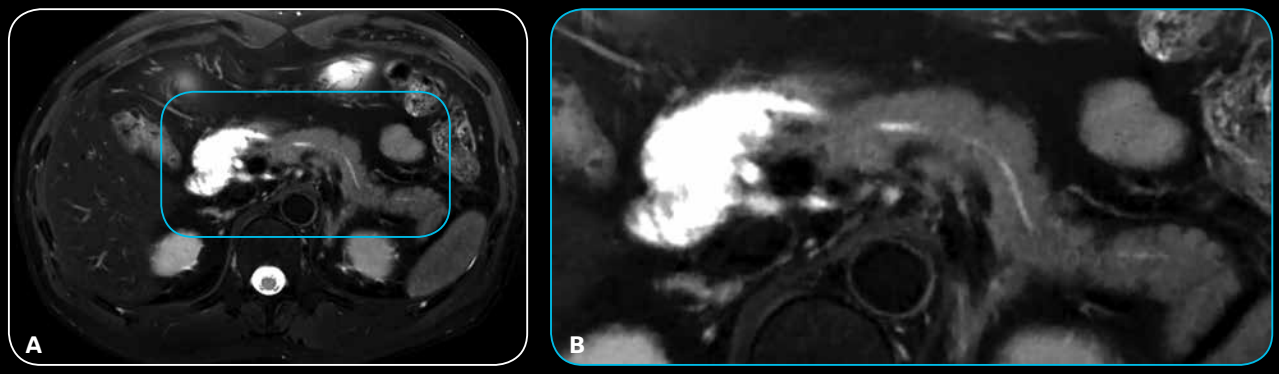


Figure 1. AIR Technology™ enables the use of higher parallel imaging factors with improved SNR for high-resolution imaging and reduced scan times. (A) Axial T2w FatSat acquisition with PROPELLER MB, 0.6 x 0.6 x 4 mm, ARC factor of 4, 4:24 min.; (B) ROI in (A) magnified.

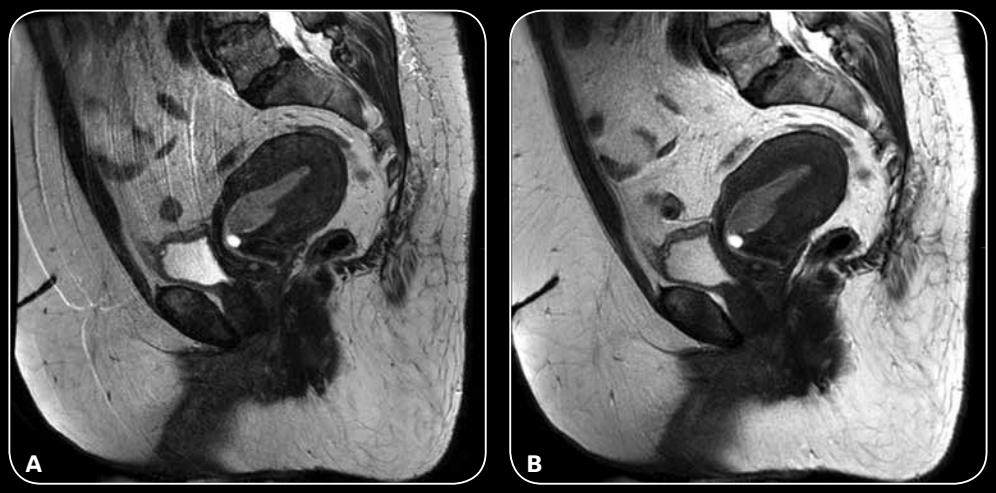


Figure 2. A female weighing 287 lbs. (130 kg) referred for MR imaging of the pelvis. (A) Sagittal T2w frFSE, 0.8 x 0.9 x 4 mm, 6:08 min.; (B) Sagittal T2w PROPELLER MB, 0.9 x 0.9 x 4 mm, 3:02 min.

motion correction. PROPELLER MB is also compatible with Auto Navigator, a free-breathing approach to combat respiratory motion in the body, cardiac and chest imaging with automatic tracker placement.

"We are now using PROPELLER MB for all abdominal cases, such as pelvis, liver and pancreas," he says. "There is also the additional big advantage of motion correction without any critical disadvantage."

For example, he obtained good contrast of the endometrium and junctional zone in a patient without motion artifact. In the upper abdomen, he acquired good images that were also not compromised due to motion (Figure 2).

It's not just the coil that is leading to excellent imaging results at Osaka University. Professor Hori found the combination of the SIGNA™ Architect, advanced sequences and AIR Technology™ together deliver robust imaging with excellent image uniformity.

"Sometimes we needed different WW/WL adjustments so we could clearly see the anatomy between the center and the edge of the FOV to make a diagnosis. Now, we no longer need to make this change in most patients," he says (Figure 3).

Professor Hori evaluated the AIR Technology™ AA and a conventional AA in a patient exam. He discovered that with the latest uniform correction application, reFINE, he could acquire higher image quality and better uniformity in many clinical cases and contrasts.

"Also, I found the AIR Technology™ AA provides better signal penetration, so image quality and SNR are better than a conventional coil, especially in large patients," he adds.

Using HyperCube with the AIR Technology™ AA in prostate imaging, Professor Hori can perform thin-slice imaging. He acquires 1-2 mm slice 3D images with HyperCube and obtains good quality compared to conventional 2D 5 mm Axial imaging. The advantage is that the thin slices provide him with a better understanding of capsular

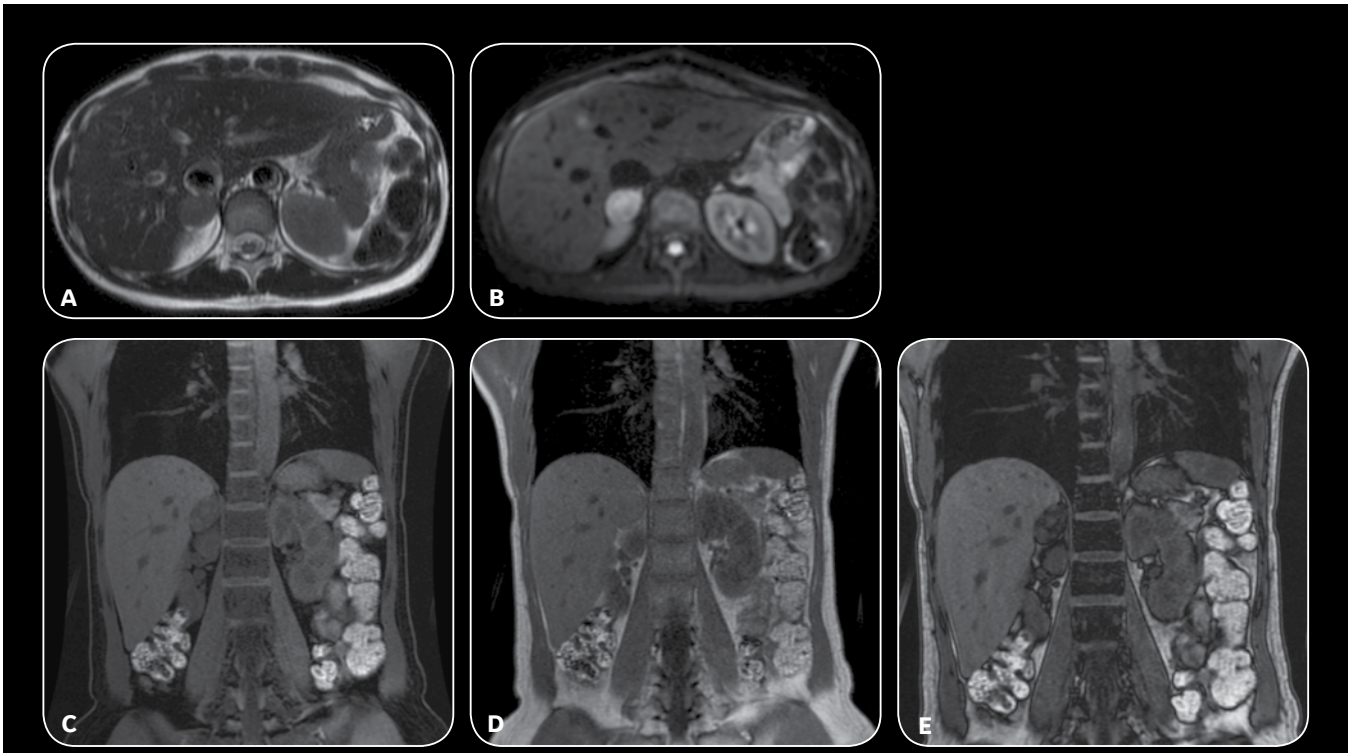


Figure 3. Patient with an adrenal mass. (A) Axial T2w SSFSE, 1.1 x 1.8 x 5 mm, 18 sec.; (B) Axial DW-EPI, 2.8 x 2.8 x 5 mm, 3:49 min. (RTr); (C-E) Coronal LAVA Flex, 1.4 x 1.6 x 3 mm, 16 sec.; (C) water, (D) in-phase and (E) out-of-phase.

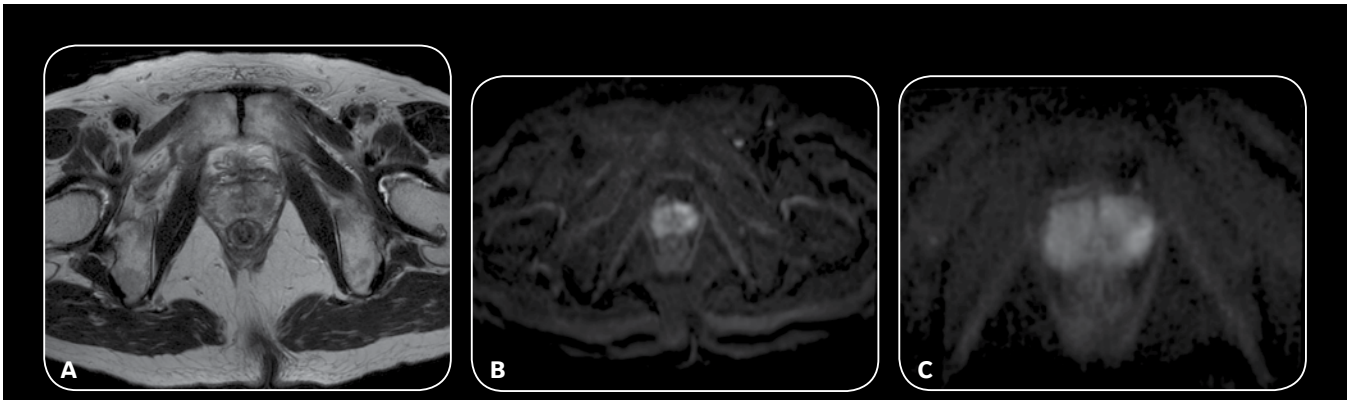


Figure 4. Prostate cancer patient (A) Axial T2w PROPELLER MB, 0.6 x 0.7 x 4 mm, 3:25 min; (B) EPI DWI b1000, 2.3 x 2.3 x 4 mm, 2:08 min.; and (C) FOCUS DWI, b1000, 1.5 x 1.5 x 4 mm, 4:10 min.

invasion, which can impact patient management and treatment options (Figures 4 and 5).

Multi-plexed Sensitivity Encoding (MUSE) DWI is another impressive application, especially in the prostate. It provides both high SNR and high spatial resolution.

"Currently, we acquire both conventional EPI DWI for the whole pelvis and FOCUS DWI for targeted small FOV with high resolution," Professor Hori explains. "However, MUSE can provide high-quality imaging in both larger and smaller FOV for the prostate," (Figure 6). In MRCP imaging, HyperSense is shortening scan times by 30 percent at Osaka University. He has also increased matrix size, from 512 x 320 to 512 x 416. With this protocol, he can more clearly see the small intrahepatic bile duct with less motion due to the shortened scan time (Figure 7).

Looking forward, Professor Hori wants to evaluate the use of AIR Technology™ in exams that require wide scan coverage, from the upper to the lower abdomen. This coil has the highest channel count and coverage in the industry today.

"With the AIR Technology™ AA, 65 cm wide coverage might be very beneficial for these types of studies," he adds.

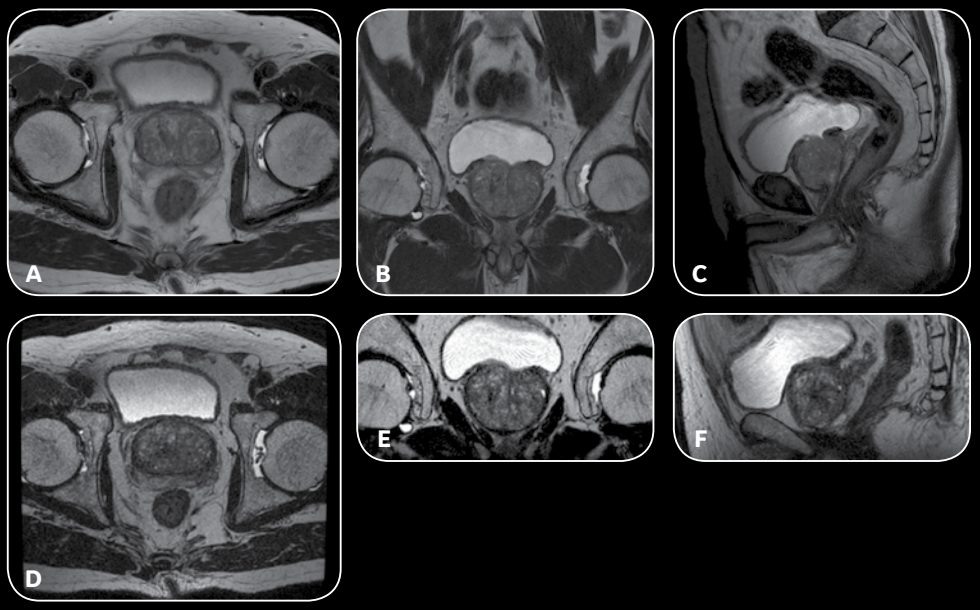


Figure 5. Prostate exam using HyperCube. (A-C) Conventional 2D T2w in 3 planes. (D-F) T2w with HyperCube enables (E-F) thin-slice imaging. (A) Axial T2w, 0.6 x 0.8 x 4 mm, 3:42 min.; (B) Coronal T2w, 0.6 x 0.8 x 4 mm, 3:25 min.; (C) Sagittal T2w, 0.6 x 0.8 x 4 mm, 2:36 min.; and (D-F) T2w with HyperCube acquired in the Axial plane and reformatted to (E) Coronal and (F) Sagittal, 0.9 x 0.9 x 2 mm, 3:54 min.

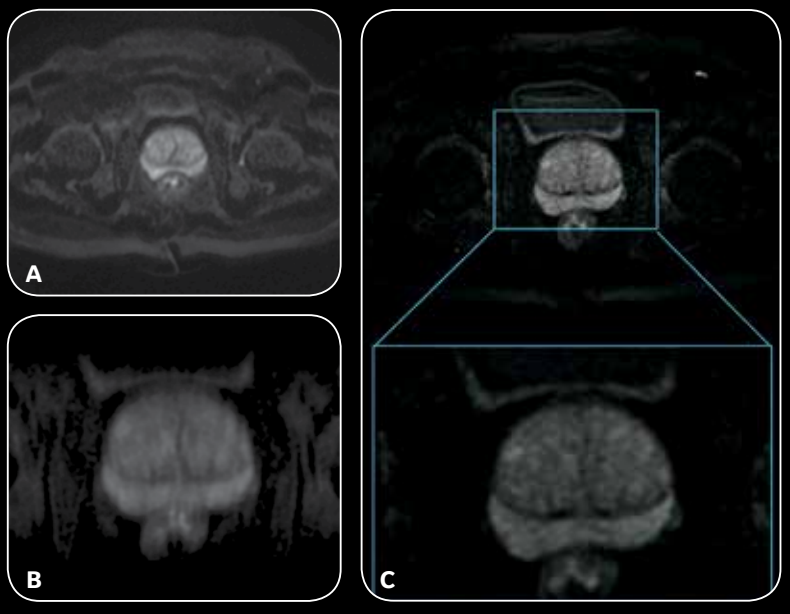


Figure 6. Patient referred for prostate exam. (A) DWI b1000, 2.3 x 2.3 x 4 mm, 2:08 min.; (B) FOCUS b1000, 1.5 x 1.8 x 4 mm, 4:10 min.; and (C) MUSE 3 shot b1000, 1.6 x 1.6 x 4 mm, 4:15 min.

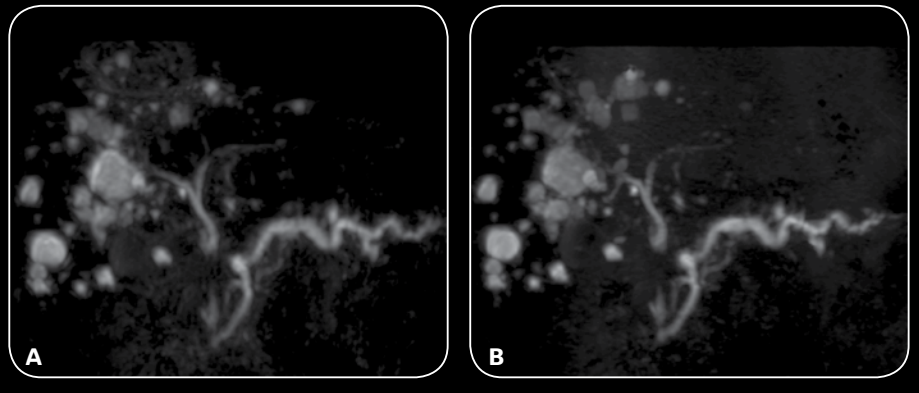
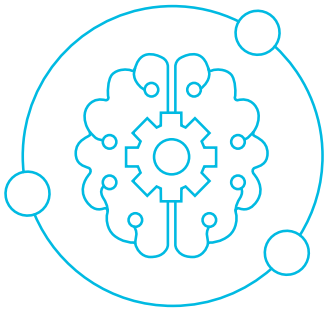


Figure 7. Comparison of MRCP exam with and without HyperSense. Scan time was reduced 30% with HyperSense. (A) Conventional MRCP RTr, 0.7 x 1.1 x 1.6 mm, 3:51 sec. and (B) MRCP RTr with HyperSense, 0.7 x 0.9 x 1.6 mm, 2:45 min.



Tom Schrack, ARMRIT, MRSO
Fairfax Radiological Consultants
Fairfax, Virginia

New deep learning tool streamlines MR slice prescription

A new deep learning software from GE Healthcare is helping streamline MR scan prescription that may help reduce inconsistencies in imaging across patients and technologists. **AI**Rx™‡ is an AI-based, automated workflow tool for MR brain scanning that automatically "prescribes" slices to help reduce redundant, manual steps. It uses deep learning algorithms built right into the MR technologist's workflow to automatically detect and prescribe slices for neurological exams, delivering consistent and quantifiable results. **AI**Rx™ also helps produce images that have less variability between technologists and between scans, helping to lower the chances a patient will be recalled due to incorrect slice placement. An increase in consistency is particularly important when doing longitudinal assessments on patients with diseases that progress over time.

"Every time I select a landmark for the prescription, the slice placement is dead on," says Tom Schrack, ARMRIT, MRSO, Manager of MR Education and Technical Development at Fairfax Radiological Consultants in Fairfax, Virginia.

Schrack and two other senior technologists at Fairfax Radiological Consultants have used a prototype of **AI**Rx™—which stands for Artificial Intelligence prescription (AI Rx)—since early November 2018, conducting about 15 cases on their facility's 3.0T SIGNA™ Architect MR scanner.

Deep learning for faster imaging

AIRx™ is built on Edison, a new platform that helps accelerate the development and adoption of AI technology and empower providers to deliver faster, more precise care. Edison is a holistic, integrated digital platform for healthcare, combining globally diverse data sets from across modalities, vendors, healthcare networks and life sciences settings.

It enables GE Healthcare to integrate and assimilate data from disparate sources, apply advanced analytics and AI to transform the data, and generate insights to support clinical, financial and operational decision-making. Edison includes deployment-agnostic intelligent applications and smart devices, designed to help achieve greater efficiency, increase access to care, and improve patient outcomes.

By leveraging this platform, **AI**Rx™ features a pre-trained neural network model that leverages deep learning algorithms and anatomy recognition based on a database of over 36,000 images sourced from clinical studies and reference sites.

AIRx™ helps increase productivity by simplifying workflow steps, thus significantly reducing user prescription time. A study showed average prescription time savings can be up to 62%.‡‡

It precisely places slices on the smallest and most challenging neurological anatomy, such as optic nerves.

"Everything that it says it can find, it finds it with amazing accuracy," says Schrack. "For example, if I tell **AI**Rx™ that I want an oblique sagittal of the left optic nerve, it puts a slice right down the center of that left optic nerve. **AI**Rx™ does that immediately and perfectly, every time. It can save me some eye strain, save time from tweaking parameters, and get me going a little bit faster."

Schrack says **AI**Rx™ is one step in the right direction of fulfilling the promise of AI, with the potential to use it on complicated anatomy such as the heart and joints, while continuing to simplify the technologist's job.

"You'll never hear a technologist say, 'I wish this was harder to use,' or 'I wish the machine would stop automating tasks for me'," says Schrack. "They want the machine to make decisions for them so that it's easier, and I think the only way that's going to happen is with deep learning and artificial intelligence. For the technologist, anything that reduces the number of decisions in an MR exam will make their job better."

‡Not available for sale in all regions..

‡‡According to an internal study conducted by GE Healthcare.

Edwin Oei, MD, PhD
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Alexander Hirsch, MD
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AIR Technology: a brilliant improvement in high-quality imaging and patient comfort

As one of the first sites in the world to install SIGNA™ Premier and AIR Technology™‡, Erasmus Medical Center is a leader in adopting cutting-edge technologies. These new solutions are providing a better patient experience while delivering high-quality imaging and advanced applications, further enhancing the excellent care provided by clinicians at Erasmus.

Erasmus Medical Center in Rotterdam, Netherlands, is a leading university medical center in Europe and has long been recognized for its adoption of cutting-edge technologies and advanced medical solutions. For the last few years, Erasmus has collaborated with GE Healthcare to evaluate the introduction of new technologies into the clinical environment. One of these is AIR Technology™.

AIR Technology™ Coils are designed to fit all patients, allow flexibility in any direction and closely wrap around the patient's anatomy for greater visibility of hard-to-scan areas with excellent image quality. By conforming to the patient habitus and bringing the coil elements closer to the patient, AIR Technology™ improves signal quality and signal-to-noise ratio (SNR) and reduces imaging artifacts when compared to previous generations of conventional coil technology.

Recently, several clinicians from Erasmus shared their initial impression of AIR Technology™ on the SIGNA™ Premier 3.0T MR system, including the AIR Technology™ Anterior Array (AA), the 48-channel Head Coil and AIR Touch™.

Cardiac imaging

Alexander Hirsch, MD, cardiologist, specializes in non-invasive cardiac imaging. In cardiac patients, Dr. Hirsch scans cardiomyopathy and ischemic heart disease patients on SIGNA™ Premier. Typically, the 2D FIESTA, first-pass perfusion and MDE images are the most common sequences for these patients. Image quality is important, particularly in the late enhancement (MDE) sequence where Dr. Hirsch evaluates myocardial viability. With the 2D FIESTA sequence, he is looking at cardiac function. However, 2D FIESTA sequences have historically been problematic at 3.0T.

"The new SIGNA™ Premier system is especially good for late enhancement images and also for perfusion," Dr. Hirsch says. "I was able to see the anatomy and the function, as well as differentiate the contrast between the blood and the

‡Not available for sale in all regions.

Juan Hernandez Tamames, PhD

Erasmus Medical Center
Rotterdam, Netherlands

Watch Dr. Hirsch's 2019 SCMR presentation, "Getting consistent and quantifiable results in cardiac imaging:" https://youtu.be/dQ3-sU-kPv0

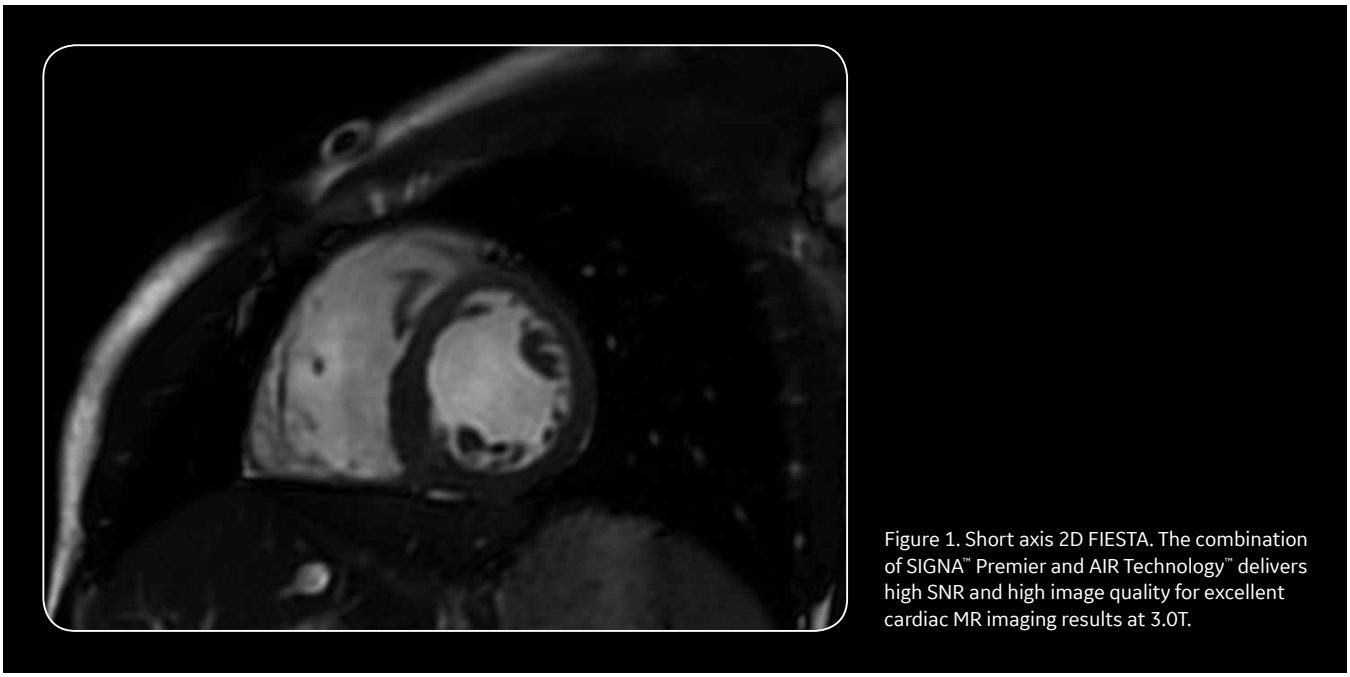

Figure 1. Short axis 2D FIESTA. The combination of SIGNA™ Premier and AIR Technology™ delivers high SNR and high image quality for excellent cardiac MR imaging results at 3.0T.

myocardium. Previously in a 3.0T system, that was a problem, however, with the SIGNA™ Premier this has improved a lot."

A key factor in the improved image quality is AIR Technology™. Dr. Hirsch says he gets a more homogeneous signal and better contrast between the blood and the myocardium.

"Because of the specialized nature of our facility, with referrals from all over the Netherlands, it is important to have the latest technology," he says. "With the new GE SIGNA™ Premier and AIR Technology™, we can provide high-quality care for our patients."

"The new AIR Technology™ AA has a major advantage in that it helps provide high image quality," Dr. Hirsch adds. Plus, with SIGNA™ Premier he has been able to achieve high SNR, which is very important for the sequences he is using. Dr. Hirsch also expects to see improvements in 4D Flow (VIosWorks), as well as the new 3D MDE sequence.

"When we started working with SIGNA™ Premier, I was pleasantly surprised to see the image quality, especially for the 2D FIESTA sequence," he says.

Brendan Bakker, MR radiographer, has developed cardiac MR (CMR) protocols at Erasmus with Dr. Hirsch. While 1.5T was typically preferred for CMR, he worked with Dr. Hirsch to evaluate CMR exams on the SIGNA™ Premier 3.0T MR system with AIR Technology™.

"The AIR Technology™ AA is brilliant and it's an improvement for the patient. It is very easy to handle, very lightweight and the quality is very good for cardiac imaging, especially on the SIGNA™ Premier system," Bakker says.

"AIR Technology™ is very flexible, you can put it around the chest or stomach but also use it around the knee or shoulders," Bakker says. "With other coils that are more rigid, this is not possible."

In pediatric imaging, the AIR Technology™ Coils fit almost like a blanket on the child, he adds.

MSK imaging

Edwin Oei, MD, PhD, is an Associate Professor of Musculoskeletal Imaging and Section Chief of Musculoskeletal Radiology at Erasmus Medical Center. He dedicates half his time to research and working with MR physicists and PhD students to improve technologies

Brendan Bakker
Erasmus Medical Center
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Jean Paul Laarhoven
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and apply MR imaging in population health studies.

"SIGNA™ Premier offers advantages in musculoskeletal imaging because of its higher gradient performance, especially when it is used with the AIR Technology™ Coil," Professor Oei says.

According to Professor Oei, musculoskeletal (MSK) MR imaging tends to suffer from artifacts and movement more than in other body parts. Often, there are difficulties with positioning patients due to their injury or ailment, as well as using the right coil. While coil selection is not as problematic in the knee or ankle, it can be more difficult when imaging the shoulder, wrists or ribs.

"With AIR Technology™, we are more flexible in choosing the coil, which allows for imaging specific body parts with greater accuracy. For patients with chronic diseases such as arthritis, it may not be easy for them to lie still in the scanner for a long time with a rigid coil. AIR Technology™ is lighter and more comfortable for the patient so, indirectly, I think it will also reduce movement artifacts. "

Professor Edwin Oei

AIR Technology™ also assists with patient positioning. When using traditional rigid coils, the body part being imaged had to be positioned precisely in the coil. With AIR Technology™, this is less of an issue.

"We mainly now use the blanket-type AA Coil and have achieved great imaging results in the chest wall and in joints," adds Professor Oei. "I think AIR Technology™ is beneficial for diverse patient groups, including pediatric and elderly patients."

Professor Oei believes there is a movement in MR imaging toward whole-body imaging, particularly for oncology. He anticipates that AIR Technology™ will provide excellent results over existing coil technology due to its wide coverage.

"Since the introduction of SIGNA™ Premier and AIR Technology™ at Erasmus, I've seen image quality improve over previous scans and I believe that AIR Technology™ can greatly improve patient throughput," Professor Oei says.

The AIR Technology™ Suite also includes a 48-channel Head Coil. Jean Paul Laarhoven, MR radiographer, has scanned patients with both the 48-channel Head Coil and the AIR Technology™ AA on SIGNA™ Premier. With the ability to adjust the coil for larger-sized heads and necks, he can accommodate more patients. He has found that patients with anxiety or claustrophobia can better tolerate the 48-channel Head Coil because the front part of the coil is slightly smaller and doesn't cover the patient's entire face.

"You can immediately see the high-quality images that the AIR Technology™ Coil captures," Laarhoven explains. "Of course, we also have the AIR Technology™ Posterior Array (PA) in the table so we only have to position the AIR Technology™ AA on top of the patient."

Improving the patient experience

Sita Ramman has been an MR radiographer for nearly 28 years at Erasmus. Often, she has had to comfort and reassure patients who are nervous about their MR exams. She will explain that they have to remain very still and may have to hold their breath while the system acquires the images.

Since the introduction of AIR Technology™, she has seen a noticeable difference.

"The patients like the AIR Technology™ Coils because they are very lightweight and flexible, and mold to the patient's anatomy," Ramman says. "For us, it is very easy to position. You just put it on the patient and that's it. That's all you have to do."

She has also used AIR Touch™, an intelligent coil localization and selection tool that enables automatic coil element selection and uniquely optimizes uniformity and SNR. AIR Touch™ informs the system when the coil is connected,

Sita Ramman
Erasmus Medical Center
Rotterdam, Netherlands

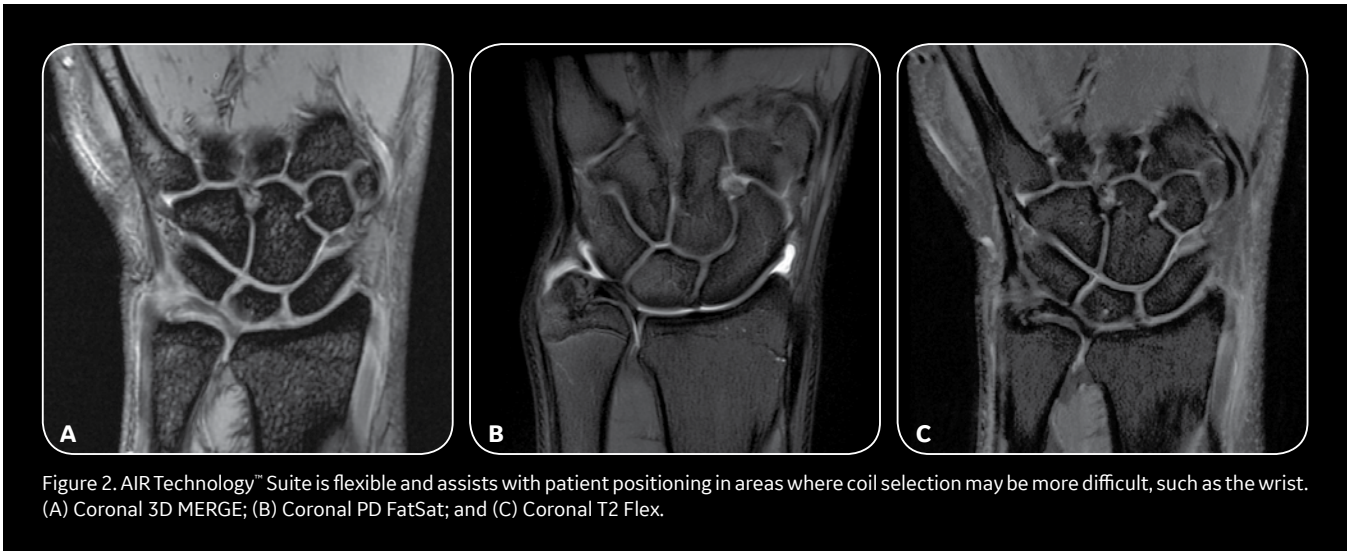

Figure 2. AIR Technology™ Suite is flexible and assists with patient positioning in areas where coil selection may be more difficult, such as the wrist. (A) Coronal 3D MERGE; (B) Coronal PD FatSat; and (C) Coronal T2 Flex.

allows the technologist to landmark the patient with a single touch and even optimizes the element configuration. Coil coverage, uniformity and parallel imaging acceleration are generated dynamically to optimize image quality. A simplified user interface allows the technologist to focus on the patient and also maximizes examination efficiency.

"We just put the AIR Technology™ Coil on the patient, localize using the AIR Touch™ button on the table and move the patient inside the SIGNA™ Premier," Ramman explains. "With AIR Technology™ and AIR Touch™, we don't need to do any calibration as it is done automatically. This makes a difference in our daily routine because it takes less time to position a patient."

A remarkable advance

Juan Hernandez Tamames, PhD, Associate Professor (MR) and Head of the MR Physics group in the radiology department at Erasmus, facilitates the introduction of new technology in MR imaging for both clinical and research purposes.

"SIGNA™ Premier incorporates several new approaches and breakthroughs in technology," Professor Tamames says. "For example, the AIR Technology™ Coils are one of the most remarkable innovations I've seen because they increase SNR."

He also discovered that the HyperBand capability on SIGNA™ Premier enables the possibility to simultaneously scan several slices, accelerating acquisition with the potential to shorten scan times when using DWI. With the parallel transmission, he can tailor the RF for specific tissues in a more appropriate way.

"Compressed sensing is another remarkable advance on SIGNA™ Premier," Professor Tamames adds. "When used with AIR Technology™, which improves signal due to the closer proximity to the patient anatomy and tissue, we can increase the acceleration with compressed sensing and parallel imaging to reduce scan times."

For example, since the lungs are filled with air, it is often difficult to obtain good SNR. Because the AIR Technology™ AA lays on the patient's chest, it is as close to the body as possible. This enables a high SNR.

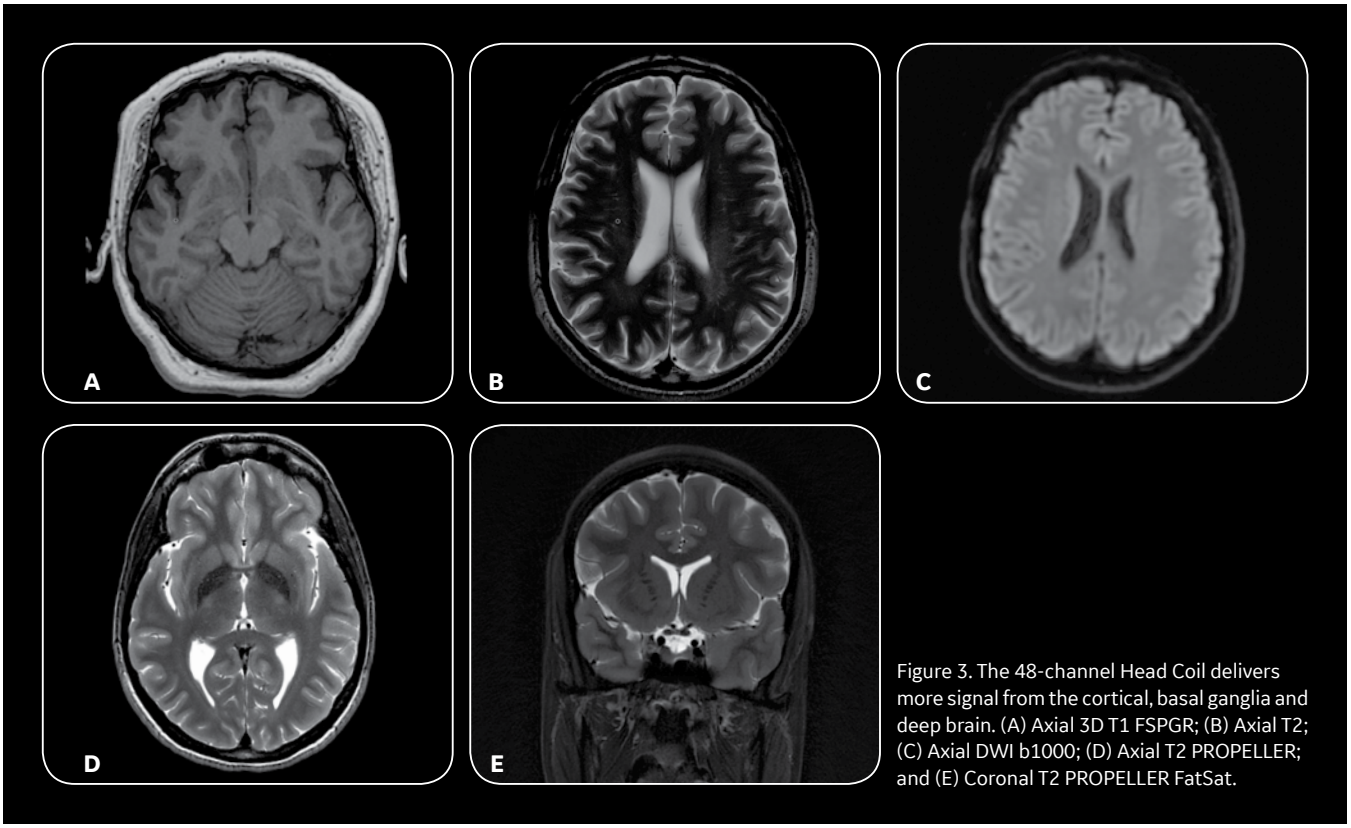

Figure 3. The 48-channel Head Coil delivers more signal from the cortical, basal ganglia and deep brain. (A) Axial 3D T1 FSPGR; (B) Axial T2; (C) Axial DWI b1000; (D) Axial T2 PROPELLER; and (E) Coronal T2 PROPELLER FatSat.

Another advantage is in pediatric imaging. Professor Tamames says a baby can be wrapped in the coil, which makes them more comfortable and enables the coil to get closer to the anatomy.

"In general, AIR Technology™ is more convenient and it can fit almost any sized anatomy," adds Professor Tamames.

Professor Tamames is interested in testing the AIR Technology™ AA with a conventional head coil and also with the 48-channel Head Coil.

"With 48-channels we can accelerate more because we have a really good, high-quality signal," Professor Tamames explains. "By accelerating, we reduce the echo time, which means less distortion in an EPI sequence. And that is important for exploring the basal ganglia and frontal or temporal areas. Not only is the signal better, but the anatomy and morphology of the tissue is more realistic."

And, because the headset for the 48-channel Head Coil is compatible with EEG systems, clinicians at Erasmus can simultaneously record EEG and capture MR images. Professor Tamames also sees the potential for continued innovation in technology and sequences to shorten MR scan times, in some cases to as quick as five or 10 minutes.

"I think SIGNA™ Premier and AIR Technology™ are paving the way to achieve this goal," Professor Tamames adds.

Watch the team at Erasmus discuss their experience with AIR Technology™.
https://youtu.be/MeGebBSjUNQ

Utaroh Motosugi, MD, PhD
University of Yamanashi Hospital,
Yamanashi, Japan

A lighter, more flexible and comfortable way to scan

At the University of Yamanashi Hospital in Japan, Utaroh Motosugi, MD, PhD, Associate Professor, Department of Radiology, is focused on research in abdominal MR imaging. Dr. Motosugi has collaborated with GE Healthcare, Richard L. Ehman, MD, Mayo Clinic and Scott Reeder, MD, PhD, University of Wisconsin-Madison using MR elastography and IDEAL IQ.

The importance of this research is underscored by the clinical needs of an aging Japanese society. Cancer, which accounts for nearly one-third of all deaths in Japan, along with Alzheimer's and heart disease, are top concerns for the country's health ministry.[1,2]

Locally, GE researchers often actively work with Dr. Motosugi and his colleagues to explore new technologies and sequences for MR imaging, including SIGNA™ Premier and AIR Technology™‡.

In March 2018, SIGNA™ Premier and the 48-channel Head Coil were installed, followed by AIR Technology™ Anterior and Posterior Arrays. The hospital already had a good experience with the Discovery™ MR750 in both clinical and research use. According to Dr. Motosugi, the university chose SIGNA™ Premier because of the SuperG gradient capabilities and the new AIR Technology™ Suite.

"We wanted to add a higher performance system that is research capable but also increases patient comfort during scanning," Dr. Motosugi says. "We found SIGNA™ Premier to be the best product for this purpose."

In the first three months of operation, the facility had performed over 400 clinical exams with SIGNA™ Premier, including 284 head/neck, 71 abdomen and 57 musculoskeletal (MSK) exams.

"AIR Technology™ is the biggest technology breakthrough in MR imaging in the last two decades," Dr. Motosugi adds. "It's a key reason to choose a GE MR system."

He cites the advantage of patient comfort with the flexible coil but also the high

‡Not available for sale in all regions.

Figure 1. Using the same AIR Technology™ Anterior Array setting, the technologist can acquire the target region of interest (FOV 13 cm) and wide coverage depicting the patient's chest, abdomen and pelvis (FOV 34 cm x 2 stations).

signal penetration and uniformity when imaging deep areas of the body as well as the lower g-factor for faster imaging.

The AIR Technology™ Suite of coils are 60% lighter than conventional hard-shell coils and are flexible to fit all body shapes, sizes and ages. In these instances, they deliver consistent, high-quality images with higher signal-to-noise ratios (SNR) and freedom in coil positioning by fitting 99.9% of the population.

In brain imaging, the 48-channel Head Coil and SIGNA™ Premier are now the preferred choice at the University of Yamanashi Hospital. Routine MSK imaging with the AIR Technology™ Anterior Array for shoulder, long bone and femoral imaging has delivered very good, uniform images with larger Z coverage than previously attainable.

"While we would like to use SIGNA™ Premier for all of our body work, we have several ongoing liver research studies on the Discovery™ MR750 that include collaboration from other sites throughout the world," he explains. "However, as a body radiologist, I'm eager to run more research on SIGNA™ Premier with AIR Technology™."

Dr. Motosugi appreciates the quality of the facility's existing 3.0T scanner but is excited by the potential from the higher performance and wider bore of SIGNA™ Premier. He also likes the sleek, modern look. With the new coil technology, his first impression is that a conventional MSK coil could be replaced with AIR Technology™ for routine clinical exams.

In abdominal imaging, deep signal penetration with AIR Technology™ Coils in pancreatic imaging has delivered better image uniformity and larger coverage. When imaging specific body areas for lesions, such as the liver or kidneys, it is not uncommon to find a lesion in another area. Prior to AIR Technology™ Coils, this required the repositioning of the coil and/or patient, taking up valuable imaging time. This is no longer the case with AIR Technology™, leading to higher efficiency and more productive exams.

One area of exploration is the use of AIR Technology™ Coils with 3D dynamic imaging and a reduction in breath-hold time. "We often want to acquire

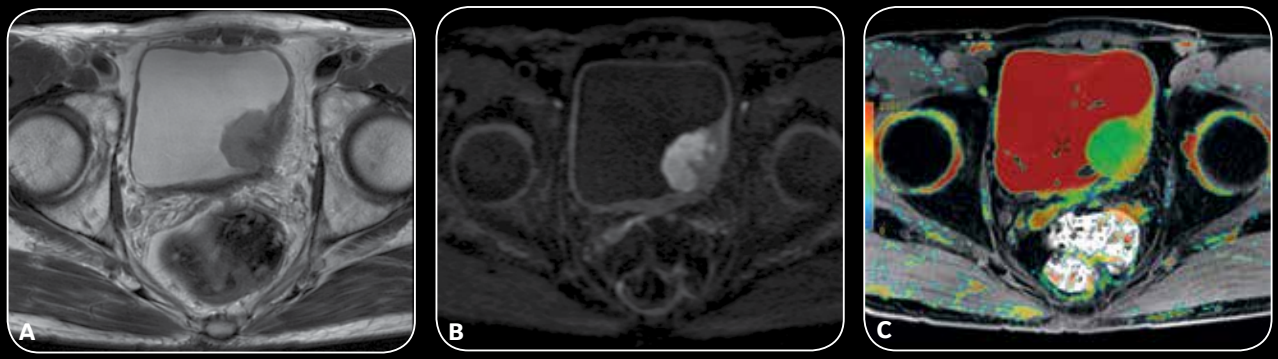

Figure 2. Images acquired on a patient with a bladder tumor using AIR Technology™ Anterior and Posterior Arrays. (A) Axial T2w PROPELLER, FOV 20 cm, Th/Sp 5 mm/0.5 mm, 288 x 288 in a scan time of 2:15 min. (B) Axial MUSE with a b1000, FOV 28 cm, Th/Sp 4mm/-2mm, 128 x 256 in a scan time of 2:30 min. (C) ADC Map.

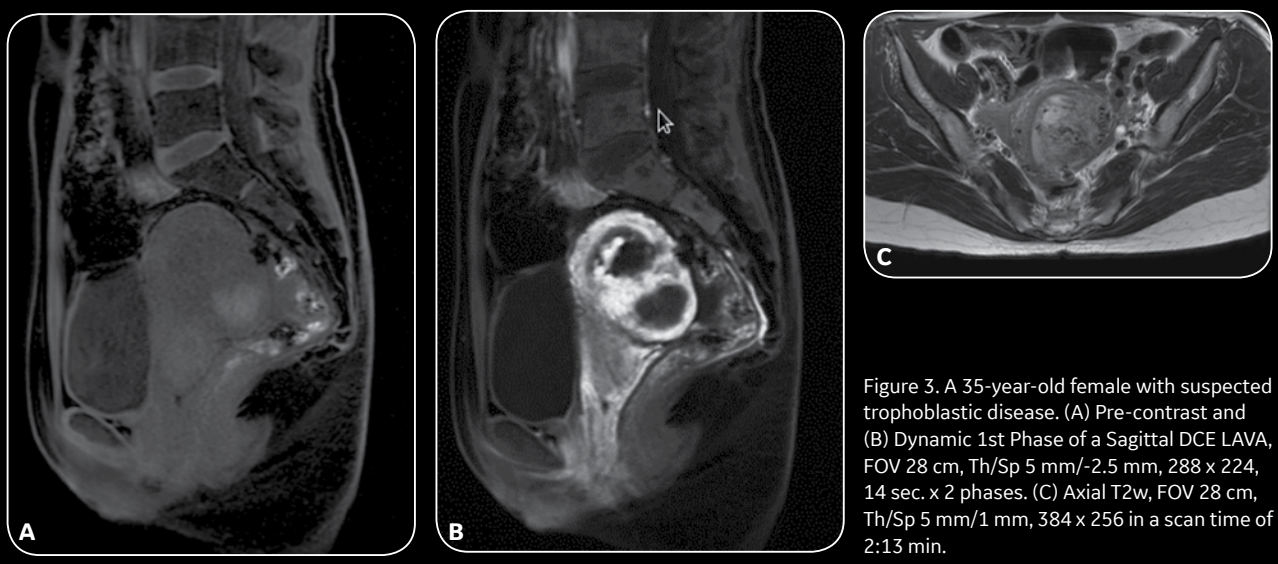

Figure 3. A 35-year-old female with suspected trophoblastic disease. (A) Pre-contrast and (B) Dynamic 1st Phase of a Sagittal DCE LAVA, FOV 28 cm, Th/Sp 5 mm/-2.5 mm, 288 x 224, 14 sec. x 2 phases. (C) Axial T2w, FOV 28 cm, Th/Sp 5 mm/1 mm, 384 x 256 in a scan time of 2:13 min.

multiple arterial phases for dynamic liver sequences with high image quality. I believe AIR Technology™ will help accelerate higher reduction factors due to the lower g-factor," Dr. Motosugi says. He also expects to see faster and higher spatial resolution volumetric imaging with the AIR Technology™ Suite. In particular, he anticipates high-resolution volumetric T2-weighted imaging in the abdomen will help him detect small cysts in the pancreas and find the relationship to the pancreatic duct, all in one scan.

In the shoulder, arm and femoral regions, AIR Technology™ Coils have replaced conventional coils for most clinical exams, especially in cases of suspected inflammatory disease. In these types of cases, the clinician needs to visualize a wide area to determine the extent of inflammation.

"Conventional rigid MSK coils cannot provide the coverage we need in cases of inflammation. This is a clear benefit of AIR Technology™."

Dr. Utaroh Motosugi

Patient positioning in upper extremity exams has also changed with the addition of AIR Technology™. Now, the technologist can position the patient in the center of the magnet for these exams, which further enhances image quality.

AIR Touch™ has also helped the technologists with reducing coil selection errors. It helps technologists determine the best configuration for each patient with an intelligent patient recognition algorithm and system intelligence to automatically optimize every scan, even the element configuration.

Reducing scan times is a key initiative at the University of Yamanashi, as it will free up SIGNA™ Premier for more research-related scanning.

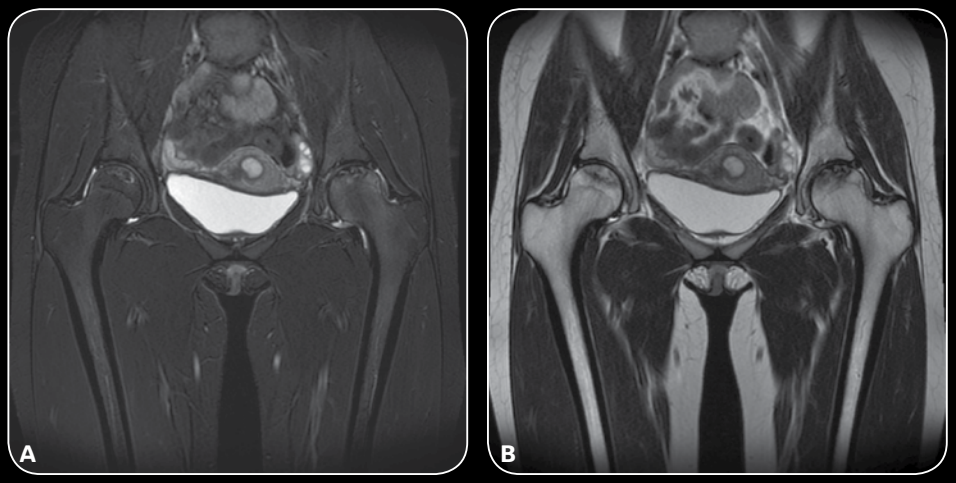

Figure 4. Image of a hip-joint depicting femoral head necrosis. (A) T2w FSE Flex Coronal (Water Image), FOV 36 cm, Th/Sp 4 mm/ 1 mm, 384 x 288 in a scan time of 1:17 min. (B) T2w FSE Flex Coronal (In-phase), FOV 36 cm, Th/Sp 4 mm/1 mm, 384 x 288 in a scan time of 1:17 min.

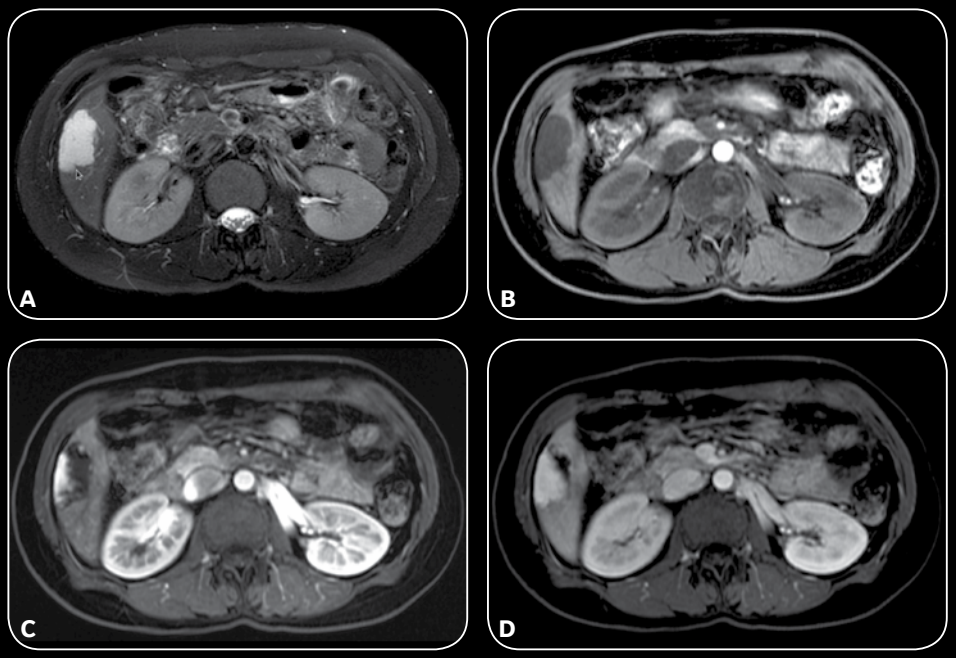

Figure 5. Liver imaging study using AIR Technology™ Anterior and Posterior Arrays to assess a hemangioma. (A) Axial T2w PROPELLER, FOV 30 cm, Th/Sp 5 mm/0 mm, 384 x 384 in scan time of 5:04 min. (B) Pre-contrast, (C) Dynamic 1st Phase and (D) Dynamic 2nd Phase.

The 48-channel Head Coil has helped immensely in this regard, reducing total exam time for a comprehensive neuro exam that includes T1-weighted, T2-weighted, FLAIR, T2*-weighted, DWI and MRA with HyperBand and HyperSense to five minutes. Dr. Motosugi believes this is 50 percent less than conventional 3.0T neuro exam times.

A quality MR system is more than just hardware. Several new sequences for body imaging have also impressed Dr. Motosugi.

"A clear benefit of MUSE DWI is less distortion," he says. In abdominal imaging, MUSE DWI was impressive. When the prior DWI sequence was compared to MUSE DWI, Dr. Motosugi and his colleagues found the older images were more distorted than they perceived at the time, even to the point of impacting a confident diagnosis.

With liver MUSE DWI, there is a reduction in the signal drop that occurs near the stomach. For MUSE DWI renal and adrenal gland imaging, the image quality is excellent in the Coronal plane without distortion. The pancreas is another area with great potential for high-resolution DWI.

"MUSE DWI is also promising in extremity imaging for detecting tumors. We were able to obtain excellent image

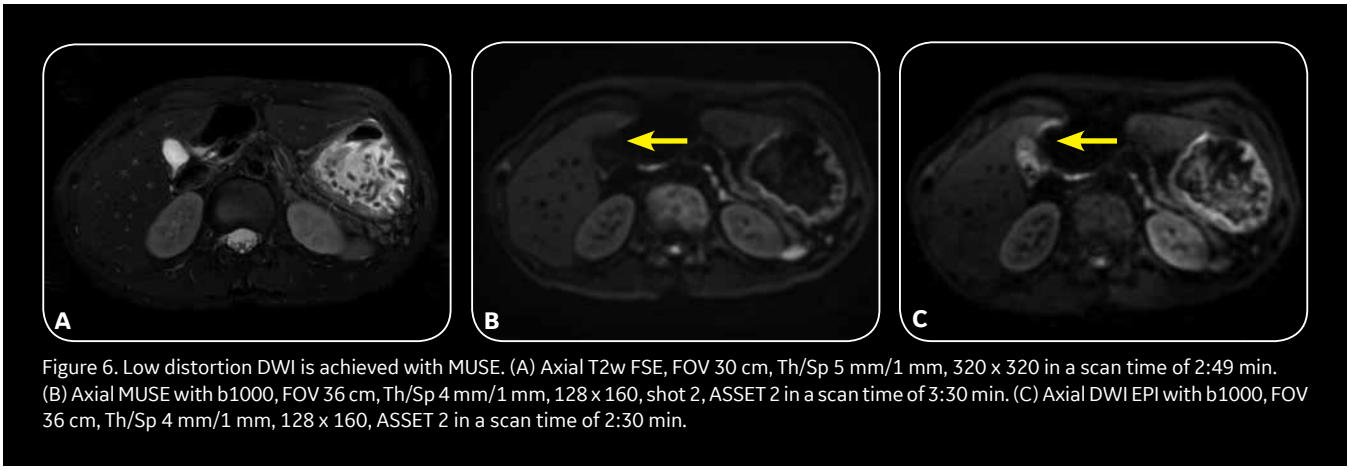

Figure 6. Low distortion DWI is achieved with MUSE. (A) Axial T2w FSE, FOV 30 cm, Th/Sp 5 mm/1 mm, 320 x 320 in a scan time of 2:49 min. (B) Axial MUSE with b1000, FOV 36 cm, Th/Sp 4 mm/1 mm, 128 x 160, shot 2, ASSET 2 in a scan time of 3:30 min. (C) Axial DWI EPI with b1000, FOV 36 cm, Th/Sp 4 mm/1 mm, 128 x 160, ASSET 2 in a scan time of 2:30 min.

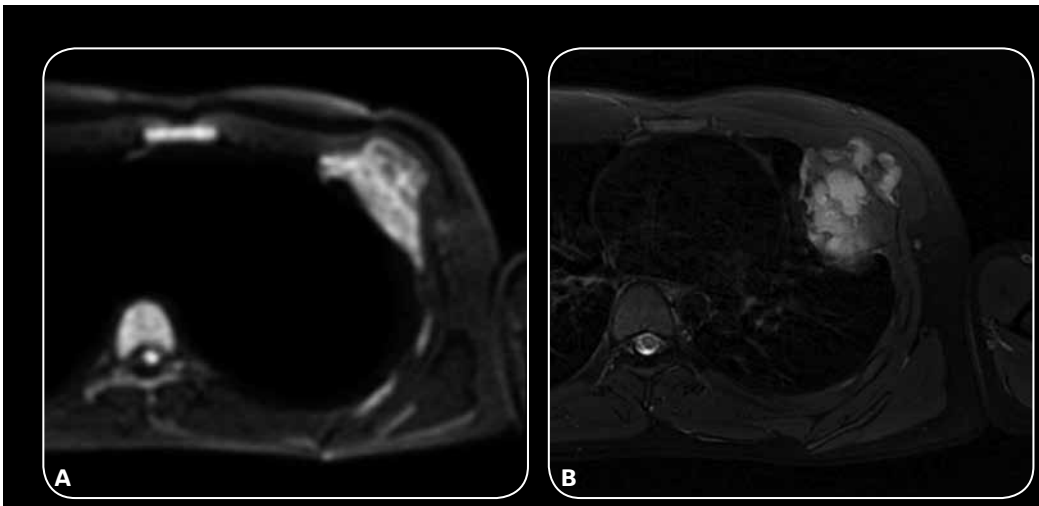

Figure 7. (A) MUSE was utilized for a DWI study of a patient with a suspected bone tumor in the fourth rib. (B) Axial T2w PROPELLER, FOV 24 cm, Th/Sp 5 mm/ 1 mm 256 x 256 in a scan time of 3:22 min.

quality in the knee and shoulder," Dr. Motosugi adds.

The University of Yamanashi is implementing free-breathing abdominal scans thanks to the addition of PROPELLER MB. So far, the imaging has been robust with great image quality.

Yet, the real test of implementing the new AIR Technology™ Coils is the impact it has on the patient experience. The first time they were used, the AIR Technology™ Coils passed the test.

"Surprisingly, the first patient we scanned with an AIR Technology™ Coil said, 'Why is it so comfortable today?' A comfortable examination for the patient is obviously a key benefit of the AIR Technology™."

Dr. Utaroh Motosugi

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Body imaging with AIR Technology Anterior Array and Posterior Array

Submitted by Quirónsalud Madrid University Hospital

Fetal imaging

By Manuel Recio Rodríguez, MD, Associate Chief of Diagnostic Imaging Department

With the AIR Technology™‡ Anterior Array (AA), we can achieve good signal penetration for fetal imaging. This enables us to obtain high-quality images of the fetal brain with short acquisition times using T2 and DWI sequences.

38-year-old pregnant woman; fetus with hydrocephalus.

Coil:	AIR Technology™ AA
Parameters:	
T2 SSFSE in three planes:	- Sagittal: 0.7 x 0.7 x 3 mm, 1:00 min. - Coronal/Axial: 0.7 x 0.7 x 2.5 mm, 1:22 min.
DWI, b800:	- Axial: 2.8 x 2.8 x 2.5 mm, 0:50 sec.

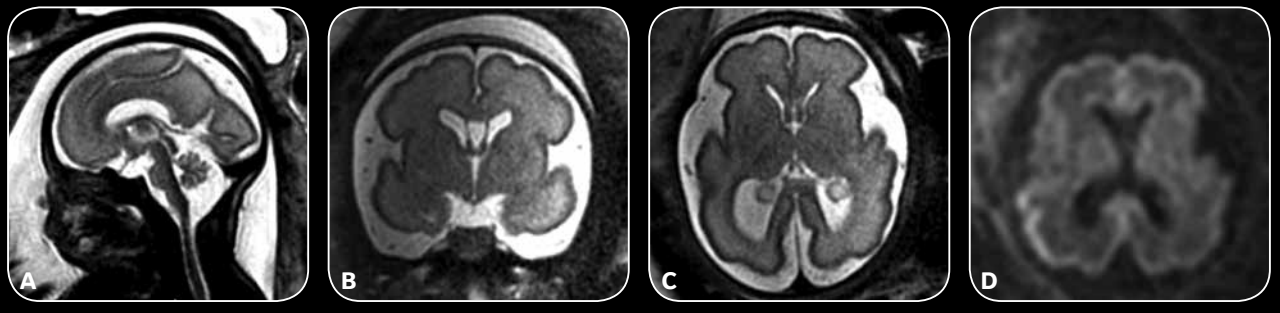


Figure 1. AIR Technology™ AA provides excellent signal penetration for high-quality images. (A) Sagittal T2 SSFSE; (B) Coronal T2 SSFSE; (C) Axial T2 SSFSE; and (D) Axial DWI b800.

‡Not available for sale in all regions.

Abdominal imaging

By Vicente Martinez de Vega, MD, Chief of Diagnostic Imaging Department

Abdominal imaging with the AIR Technology™ Coils is better than we expected, particularly the coverage, signal homogeneity, high spatial resolution and scanning speed. We were also able to achieve short acquisition times and homogenous fat suppression. In this particular case, a thickening of the terminal ileum can be noticed in a very short segment, which is consistent with Crohn's disease.

48-year-old male with Crohn's disease.

Coils:	AIR Technology™ AA and Posterior Array (PA)
Parameters:	
T2 SSFSE in two planes with and without FatSat:	- Axial: 0.8 x 1 x 4 mm, 0:52 sec. - Axial w/FatSat: 0.9 x 0.9 x 4 mm, 0:54 sec. - Coronal: 1 x 1.25 x 4 mm, 0:38 sec.
Axial DWI:	b1000, 2.9 x 1.2 x 5 mm
T1 LAVA ASPIR in two planes:	- Axial 1 x 1.25 x 2.4 mm, 0:24 sec. - Coronal: 1 x 1.25 x 3 mm, 0:19 sec.
Coronal T1 DISCO:	1 x 1.6 x 2 mm, 7 sec./phase
Coronal T2 FIESTA dynamic:	1 x 1 x 3 mm, 0:54 sec.

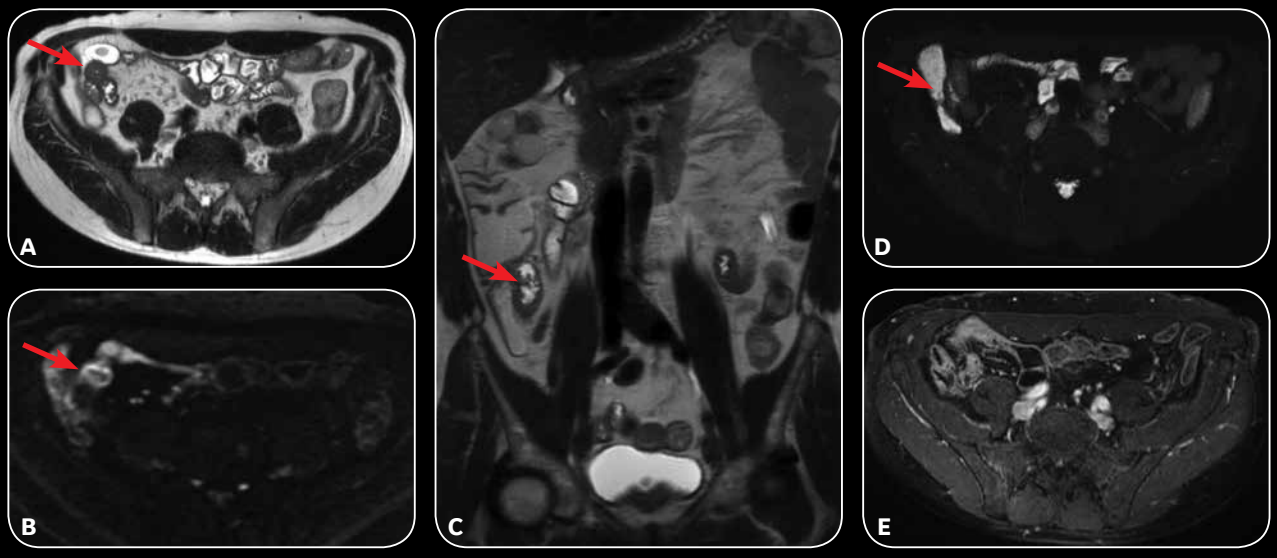


Figure 2. AIR Technology™ AA and PA Coils for abdominal imaging deliver better than expected coverage, signal homogeneity, high spatial resolution and homogeneous fat suppression. A thickening of the terminal ileum (red arrows) is consistent with Crohn's disease. (A) Axial T2 SSFSE; (B) Axial DWI b1000; (C) Coronal T2 SSFSE; (D) Axial T2 SSFSE FatSat; and (E) Axial T1 LAVA ASPIR.

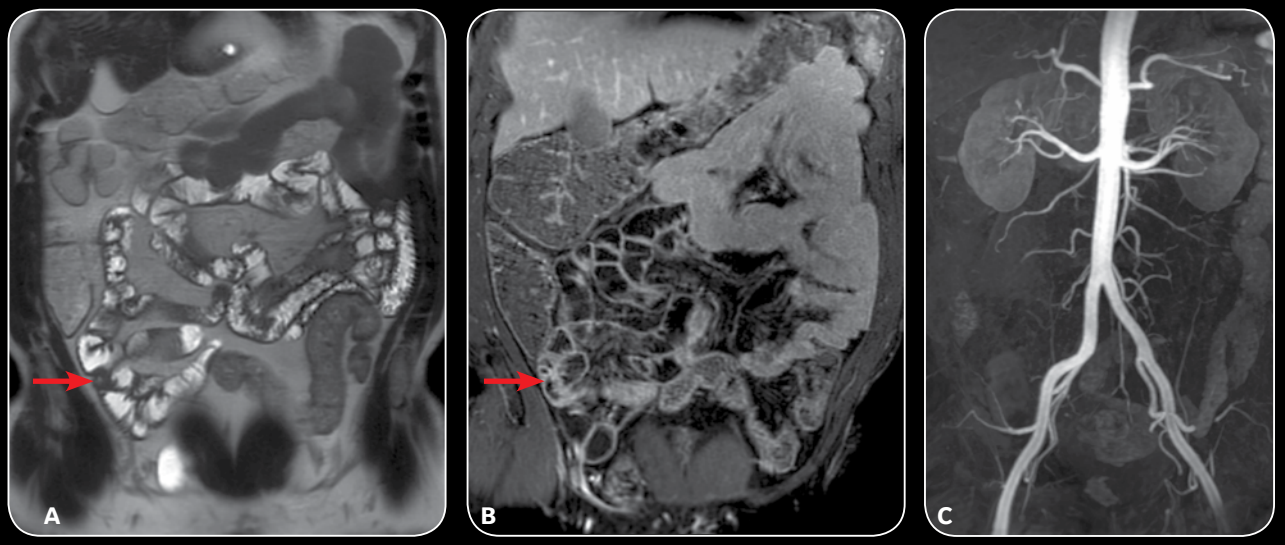


Figure 3. A thickening of the terminal ileum (red arrows) is consistent with Crohn's disease. (A) Coronal T2 SSFSE; (B) Coronal T1 LAVA ASPIR; and (C) MIP from DISCO, arterial phase.

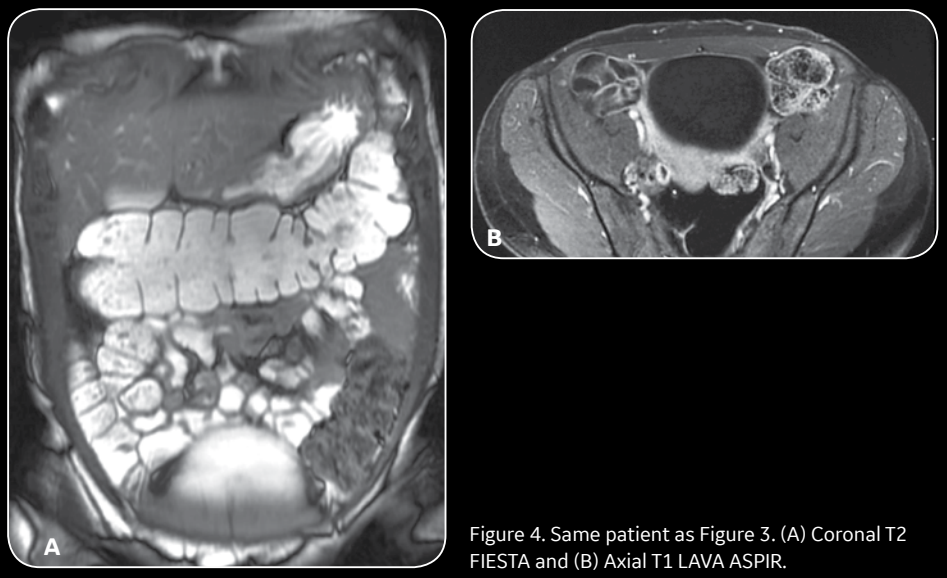


Figure 4. Same patient as Figure 3. (A) Coronal T2 FIESTA and (B) Axial T1 LAVA ASPIR.

Prostate imaging

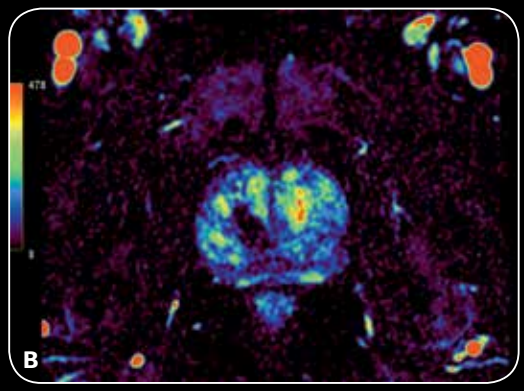
By Manuel Recio Rodríguez, MD, Associate Chief of Diagnostic Imaging Department

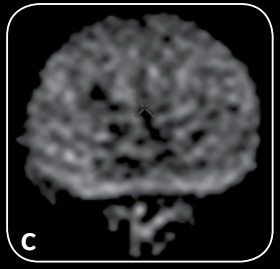
Prostate MR is growing in use and referrals in our institution. However, in order to clearly depict the cancer to determine the extent of disease, it is necessary to obtain T2 sequences with high spatial resolution. Also, T2 Cube images can be used to merge with ultrasound to assist in performing targeted biopsies. In this particular case, a lesion with high signal in the T2-weighted sequence in the central prostate can be seen. There is no enhancement in the dynamic sequence and restricted diffusion is consistent with a prostate abscess. Dynamic acquisition with DISCO LAVA provides high spatial and temporal resolution (4.5 seconds per phase) and the diffusion imaging is very high quality.

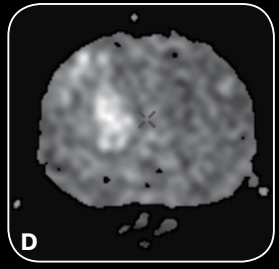
71-year-old male with prostate cystic adenoma.

Coils:	AIR Technology™ AA and PA
Parameters:	
Axial T2 FSE:	3 x 0.4 x 0.7 mm, 4:47 min.
Axial T2 Cube:	0.5 x 0.8 x 0.8 mm, 5:31 min.
FOCUS DWI:	b800, 3 x 2 x 2 mm
	MAGiC DWI: b1500
Axial DISCO LAVA:	1.5 x 1 x 1 mm, 4.5 sec./phase

Figure 5. AIR Technology™ AA and PA provide high spatial resolution in T2 sequences, which improves visualization of the cancerous lesion for staging. Note the lesion with a high signal in the central prostate. (A) Axial T2 and (B) Axial T2 Cube.







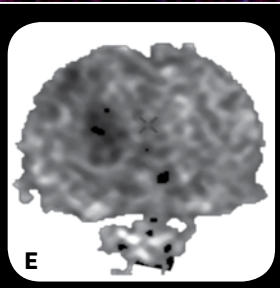


Figure 6. There is no enhancement in the dynamic sequence and restricted diffusion is consistent with a prostate abscess. (A) Axial DISCO LAVA; (B) enhancement integral map; (C) Axial DWI FOCUS b800; (D) ADC map; and (E) MAGiC DWI b1500.

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Neuro imaging with 48-channel Head Coil

By Krisztina Baráth, MD, neuroradiologist, and Brigitte Trudel, RT(R)(MR), MRI Chief Technologist, RNR Institute of Radiology and Neuroradiology at Glattzentrum

When scanning with the new 48-channel Head Coil on the SIGNA™ Pioneer 3.0T MR system, routine neuro acquisitions show significantly higher signal-to-noise ratio (SNR) compared to prior acquisitions with the conventional Head Neck Unit (HNU) coil.

With the embedded AIR Technology™ element design, we can observe a very homogenous signal distribution over the whole field-of-view without any signal drop in the center of the brain. In our experience, we know this is not the case for every dedicated neuro coil available on the market.

Additionally, the coverage of the coil in the z-direction gives us the versatility to easily scan the brain and cervical spine for multiple sclerosis as well as carotid MRA studies.

The 48-channel Head Coil has an adaptable design with an additional 3 cm expansion to gain more room for very large-sized heads and necks. It also helps reduce the patient feeling confined or having their nose in contact with the front of the coil. The coil is compatible with the comfort tilt device, which is very important when scanning elderly patients suffering from kyphosis because it helps them lie comfortably on the table. It is essential for our dementia protocols that the patient not move during scanning due to discomfort.

By combining the advantage of extra SNR with high ARC factors and new acceleration techniques, such as HyperSense and HyperBand, we are able to decrease significantly our total examination time for neuro protocols by 25% while maintaining or even increasing image quality and spatial resolution.

The 48-channel Head Coil is a real asset for us as a neuroradiological institute and it further extends the clinical benefits of a powerful 3.0T MR system such as the SIGNA™ Pioneer.

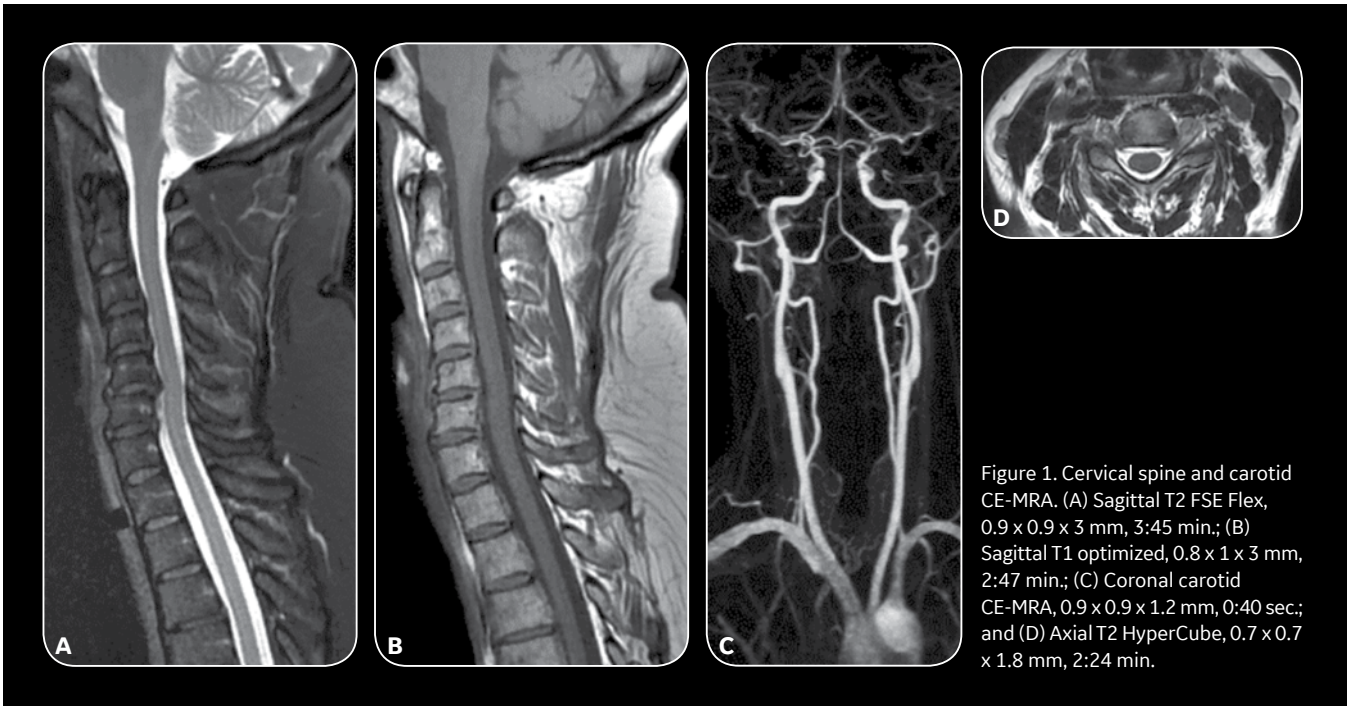

Figure 1. Cervical spine and carotid CE-MRA. (A) Sagittal T2 FSE Flex, 0.9 x 0.9 x 3 mm, 3:45 min.; (B) Sagittal T1 optimized, 0.8 x 1 x 3 mm, 2:47 min.; (C) Coronal carotid CE-MRA, 0.9 x 0.9 x 1.2 mm, 0:40 sec.; and (D) Axial T2 HyperCube, 0.7 x 0.7 x 1.8 mm, 2:24 min.

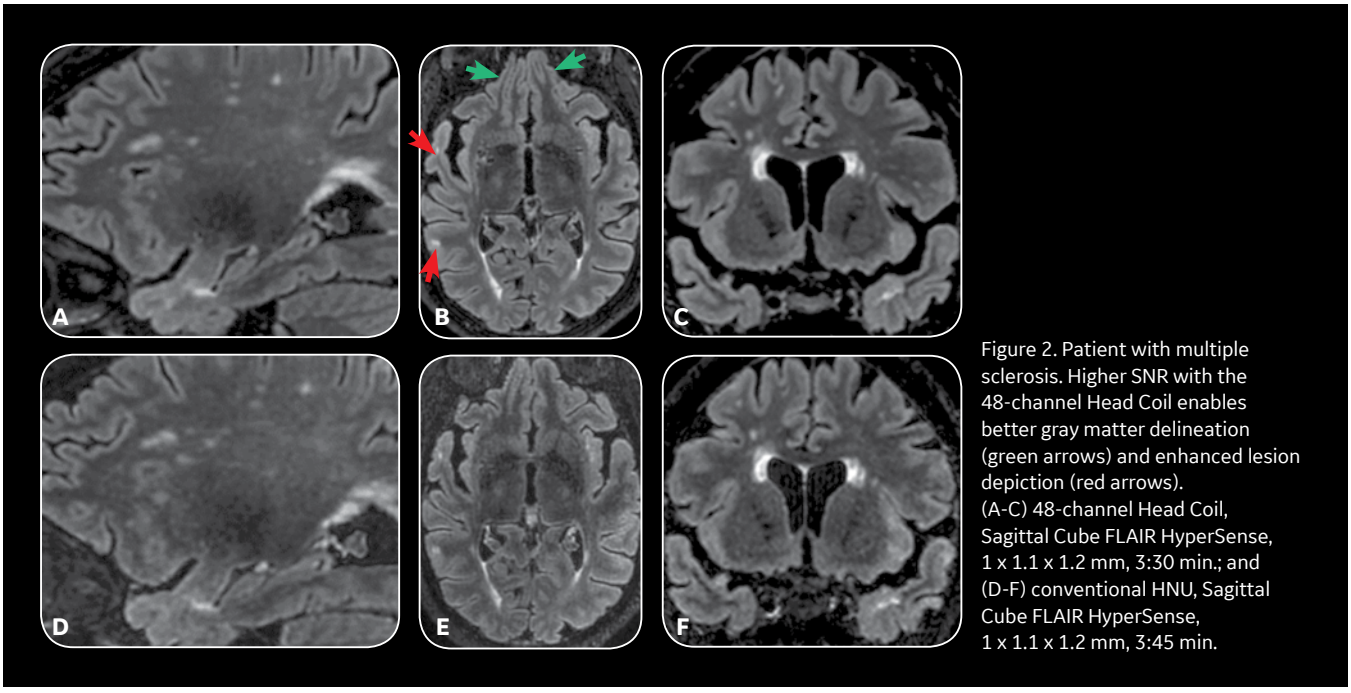

Figure 2. Patient with multiple sclerosis. Higher SNR with the 48-channel Head Coil enables better gray matter delineation (green arrows) and enhanced lesion depiction (red arrows). (A-C) 48-channel Head Coil, Sagittal Cube FLAIR HyperSense, 1 x 1.1 x 1.2 mm, 3:30 min.; and (D-F) conventional HNU, Sagittal Cube FLAIR HyperSense, 1 x 1.1 x 1.2 mm, 3:45 min.

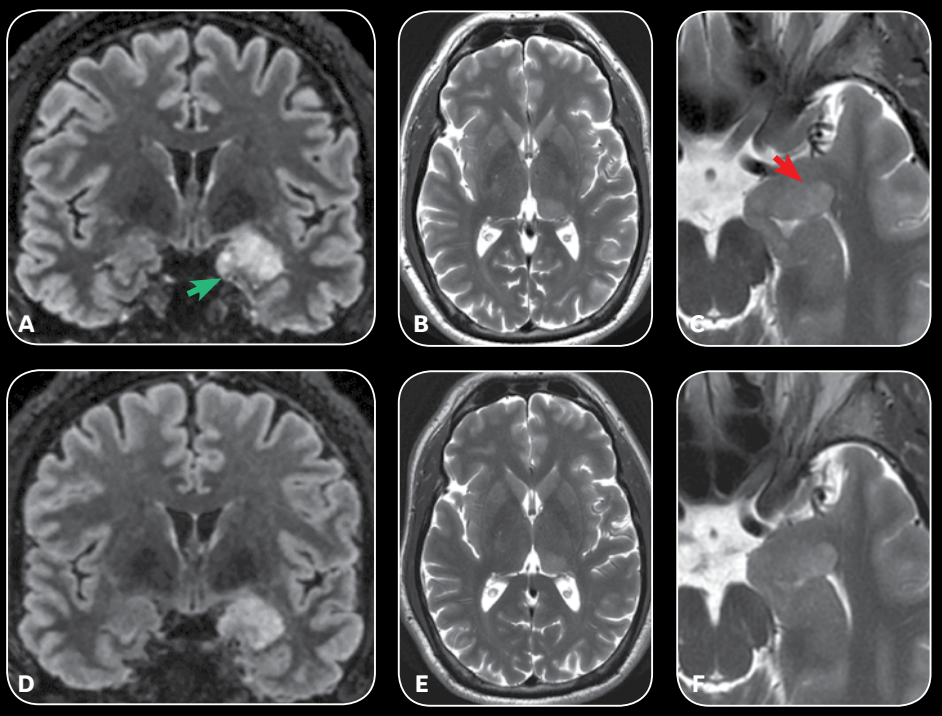

Figure 3. Patient with low-grade glioma. Higher SNR with the (A-C) 48-channel Head Coil enables better in-plane resolution (green arrow) and enhanced lesion depiction (red arrow) than (D-F) images acquired with conventional HNU. (A, D) Cube FLAIR with HyperSense, 1 x 1.1 x 1.2 mm, 3:38 min. with 48-channel Head Coil and 3:45 min. with conventional HNU; (B, C, E, F) Axial T2 PROPELLER, 0.5 x 0.5 x 3 mm, 2:10 min. with 48-channel Head Coil and 0.6 x 0.6 x 3 mm, 2:23 min. with conventional HNU.

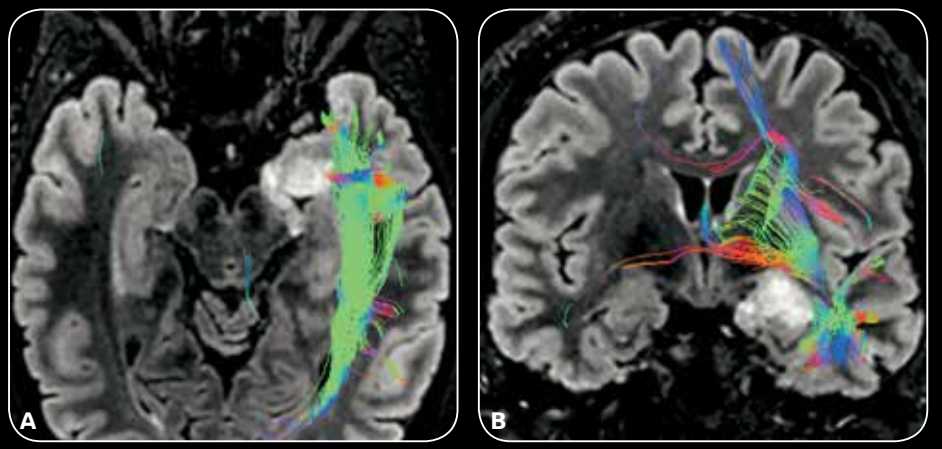

Figure 4. Patient with low-grade glioma. (A, B) DTI HyperBand with 32 directions, 2.2 x 1.8 x 4 mm, 3:43 min.

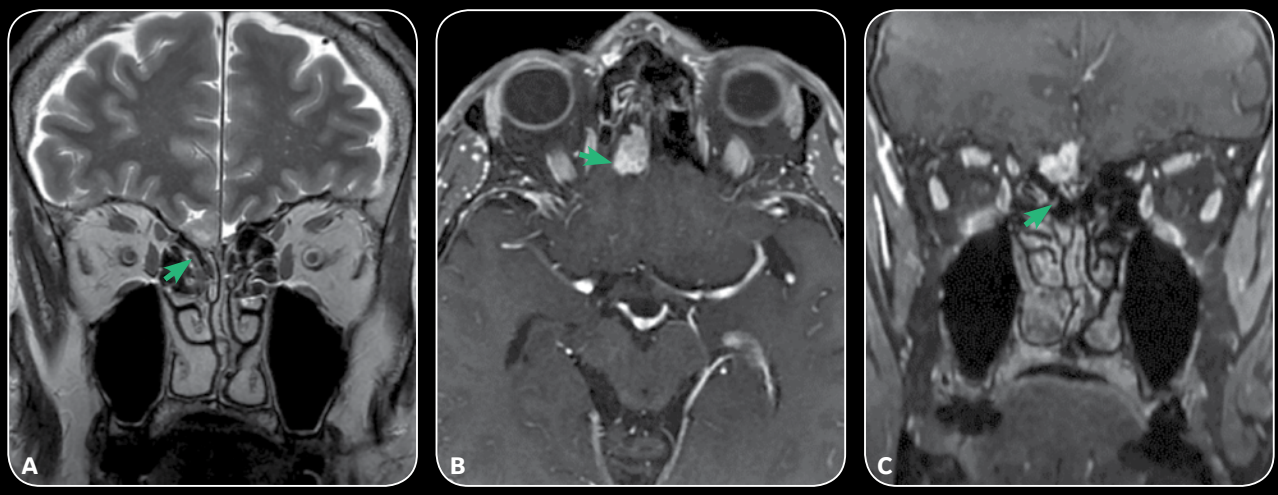

Figure 5. Patient with meningioma scanned with the 48-channel Head Coil. (A) Coronal T2, 0.5 x 0.6 x 3 mm, 2:15 min.; (B) Axial LAVA ASPIR post contrast, 0.8 x 0.8 x 1 mm, 3:50 min. with (C) Coronal reformat.

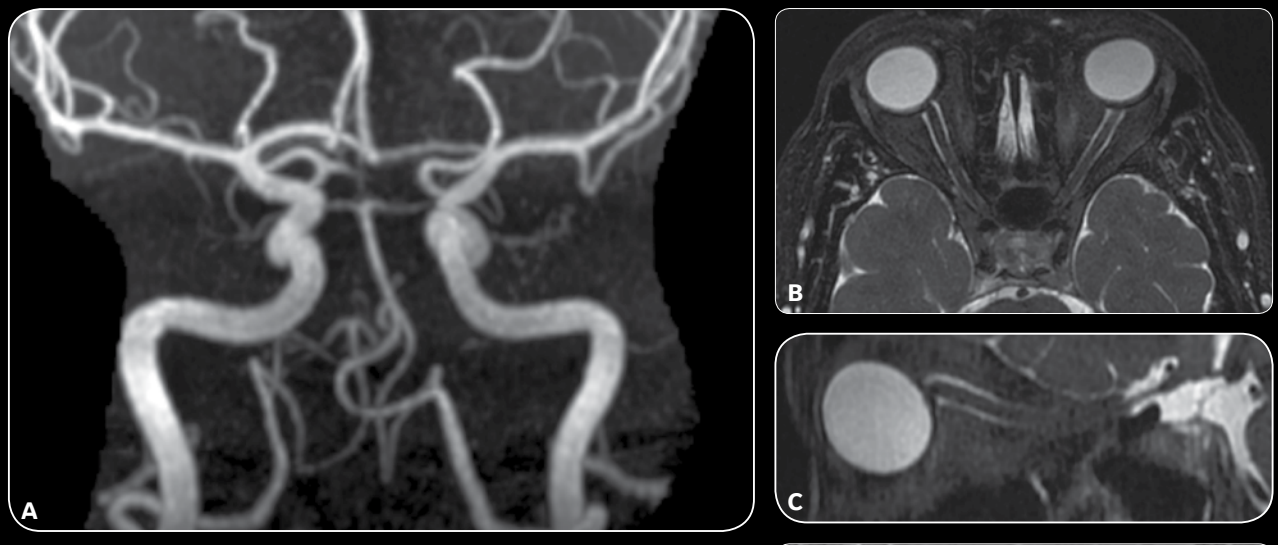

Figure 6. Standard brain and orbits protocols acquired with the 48-channel Head Coil. (A) TOF with HyperSense, 0.7 x 0.7 x 1 mm, 3:21 min.; with (C) Sagittal and (D) Coronal reformats; and (B) Axial T2 HyperCube with Flex and HyperSense, 3:53 min.

Diffusion imaging with AIR Technology Suite

Submitted by Kawasaki Saiwai Hospital

Case 1

A 59-year-old female with loss of consciousness. Prior history includes gall bladder stone and cholecystitis.

MR findings

Patient has multiple infarction. Micro infarction was not clearly visualized in conventional DWI sequence. However, MUSE enabled high-resolution DWI that enabled depiction of micro infarction in the gray matter.

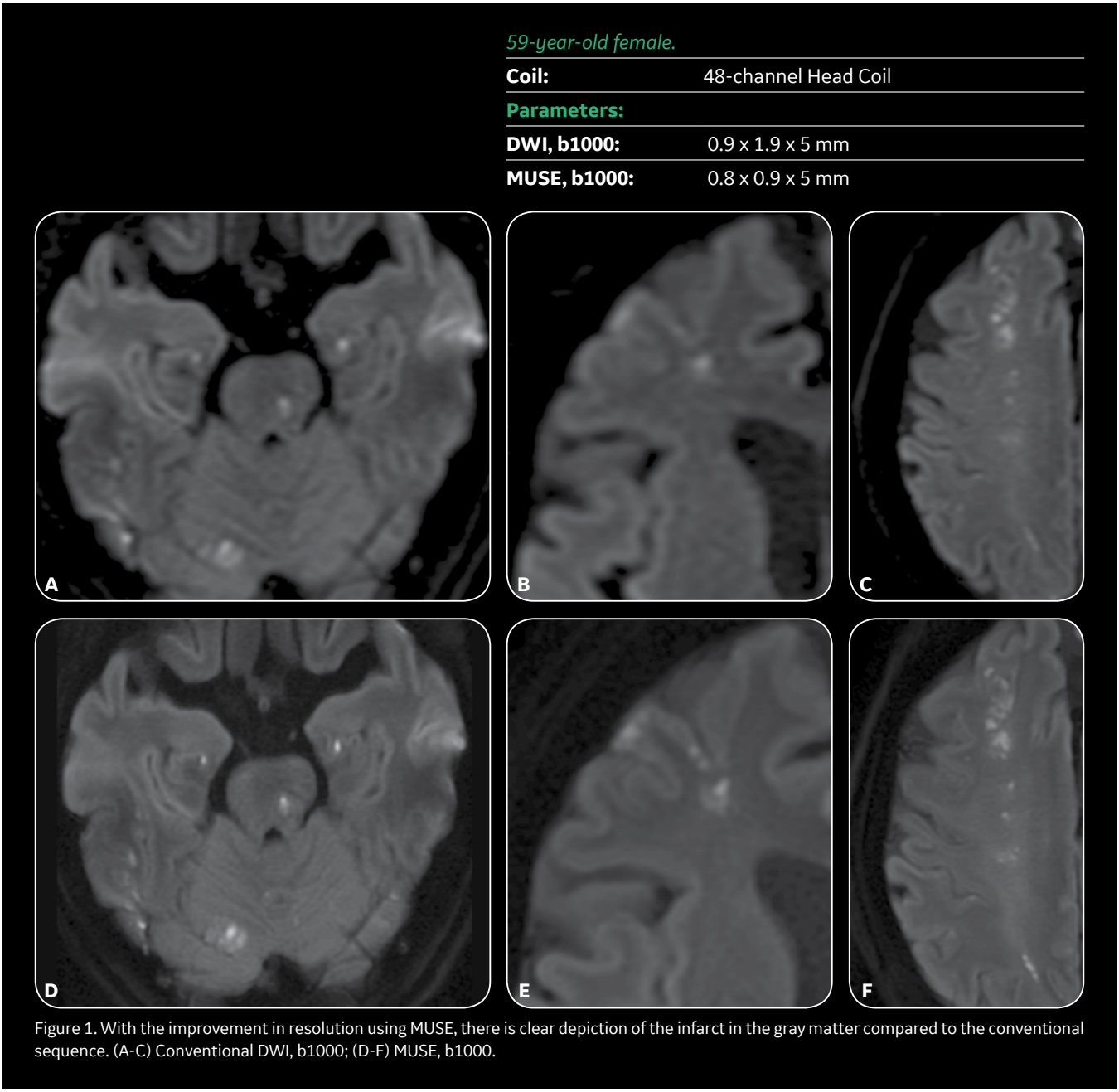

Figure 1. With the improvement in resolution using MUSE, there is clear depiction of the infarct in the gray matter compared to the conventional sequence. (A-C) Conventional DWI, b1000; (D-F) MUSE, b1000.

Case 2

A 46-year-old male presenting with fever of unknown origin and suspected infection after aortic stent replacement surgery.

MR findings

T2 SSFSE and T2 STIR PROPELLER MB confirmed abscess formation in the left upper lung lobe without having to reposition the coil. High signal DWI confirmed location. Whole-body Coronal DWI was acquired in two stations. The AIR Technology™‡ Anterior Array (AA) allows higher parallel imaging factors, enabling low-distortion DWI even in cases with a large field-of-view. S

‡Not available for sale in all regions.

46-year-old male.

Coil:	AIR Technology™ AA
Parameters:	
T2 STIR PROPELLER MB:	1.6 x 1.6 x 5 mm ARC factor of 3 3:49 min.
T2-weighted SSFSE:	1.3 x 2.1 x 5 mm 1:10 min.
Whole-body DWI, b800:	2 station Coronal DWI, 1.8 x 4.2 x 5 mm Acc 2.0/4.0 4:00 min.

Figure 2. (A) Coronal T2w STIR PROPELLER MB; (B) Coronal LAVA; (C) Coronal DW-EPI, 2 stations; (D) whole-body DWI, radial MIP; (E) whole-body Coronal DWI radial MIP, 2 stations.

Simply better

AIR Technology™ transforms the MR experience. Its flexible and versatile coil design conforms to almost any part of the human body, so you can get closer to the anatomy you need to see. When paired with intelligent applications that automate and personalize your workflow, you'll be able to achieve industry-leading productivity and image quality. Imagine the possibilities with an MR experience that's simply better.

To learn more, visit us online at gehealthcare.com/AIR.

gehealthcare.com/mr

Simply better compared to conventional technology.

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