

The background of the cover is a photograph of a woman in white medical scrubs kneeling and smiling at a young child with curly hair. The child is standing and looking towards the left. In the background, a large, circular opening of an MRI machine is visible, with the word 'PHILIPS' printed on its inner rim. The overall color palette is soft, with purples, blues, and whites.

PHILIPS

MRI magazine

Publication for the Philips MRI community **Issue 58 – 2022**

FieldStrength

Excellence in pediatric MRI

Hospital sees leap in
pediatric MRI confidence

Fetal cardiac MR with
ultrasound gating device

Achieving more

Helping the multitasking
MR technologist

MRI for visualizing prostate
lesions and guiding biopsy



Dear Friends,

At Philips, we challenge conventional thinking and push the boundaries to achieve the fastest, fully personalized MR exam for every patient in any condition, while acting responsibly towards our planet and society.

This issue of FieldStrength presents some of our latest advances in pediatric MR imaging. Our comprehensive solutions include more than just the scanner and its features. For your youngest patients we aim to reduce scan time, minimize the need for sedation, limit the use of contrast agent and provide a relaxing experience – all while offering excellent image quality.

Philips innovations in MR are patient-driven and based on deep customer insights, enhanced by working with trusted partners like you. Through our Philips Pediatric MRI network, we hear how we've been able to help users improve the patient experience.

In this issue you'll find out what procedural improvements Altona Children's Hospital was able to make after installing their state-of-the-art Ambition MR system. And you'll learn how a new ultrasound cardiac triggering device enables MR imaging of the fetal heart to aid in prenatal diagnosis and in preparation for surgery after delivery.

Beyond pediatrics, I recommend the article that focuses on MR technologists and their key role in both accommodating and guiding patients through exams that result in high quality images. Measurable workflow improvements result in a well-planned, well-managed patient schedule that allows the technologist more time to focus on the patient.

We also visit with Dr. Steiner of Wellspan York Hospital to understand how he benefits from reduced scan time, improved patient comfort, and fast and easy data analysis during multiparametric 3.0T MRI of the prostate. Importantly, we discover how he uses MRI images for live guidance during prostate biopsy to boost his ability to definitively diagnose prostate cancer.

I am inspired to continually advance the state of precision diagnosis with customer- and patient-centric MR solutions that deliver clear care pathways and predictable outcomes. Join me in advancing the future of MR.

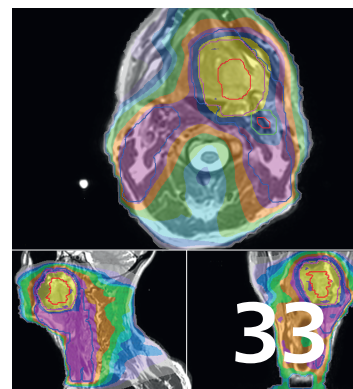
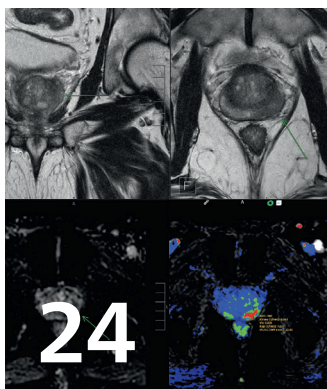
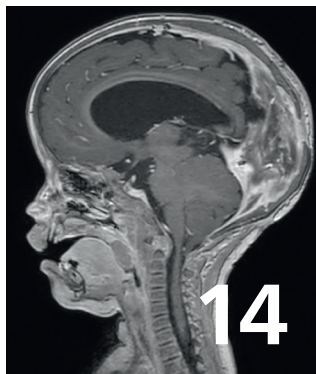
Enjoy reading!

A stylized, handwritten signature in blue ink, representing Margriet Nijdens.

Margriet Nijdens

Head of Global Product Marketing MR, Philips

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*Formal registered name is Prodiva 1.5T CS/CX

Results from case studies are not predictive of results in other cases. Results in other cases may vary.
Results obtained by facilities described in this issue may not be typical for all facilities.

Focus on the child for excellence in Pediatric MRI

MRI is often considered a favorable diagnostic modality for children, due to its exceptional image quality and absence of ionizing radiation. At Philips we believe that achieving the best MRI results for pediatric patients requires a holistic approach. A well-prepared child, a relaxing environment, and fast, first-time-right scanning benefit the patient's experience and contribute to the diagnostic outcome of the MRI examination.

Children are not small adults and scanning them is very different. Their smaller anatomies require higher resolution, tissues are constantly developing, and anxiety and the inability to lie still require sedation or special attention from the staff.

Peer-to-peer knowledge sharing

Philips has a long standing network of pediatric MR users, representing a wealth of knowledge which is shared regularly in user meetings. These experiences and knowledge feed ongoing innovation through collaboration.



Our focus to improve pediatric MRI:

- Holistic and solution-driven approach for continuous improvement in pediatric care
- Commitment to collaboration, shared vision, and people-focused patient-centric goals

Fetal cardiac MR with ultrasound gating

Philips now offers an MR-safe Doppler ultrasound **device** that enables fetal cardiac MRI in clinical practice. Using this device cardiac gating of the fetal heart and synchronization with MR acquisition is possible.

A reliable fetal cardiac gating signal allows to perform robust fetal cardiac MR as an additional means for fetal congenital heart disease diagnosis. For example, when fetal cardiac echocardiography is inconclusive, MRI studies of heart anatomy and function can provide valuable information to aid in prenatal diagnosis and in preparation for surgery after delivery. The ultrasound-based trigger signal is reliable and easy to use due to its wireless connection.



Options to make MRI scans easier for children

Obtaining high quality imaging for a confident diagnosis requires the patient to lie still. This is very challenging for children. However, a colorful scanner room that offers a relaxing audiovisual **experience**, soft mattresses and the opportunity to view a **movie during the scan**, can distract and help the child to stay still.

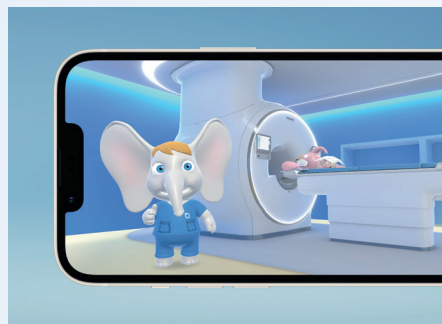
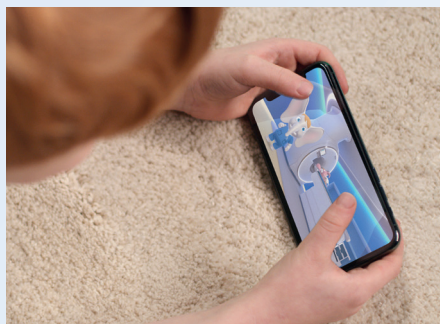
Reducing the time a child needs to lie still, can also help. Philips **Compressed SENSE** technology allows all anatomical scans to be shortened by up to 50% with virtually equal image quality*. By applying **motion reduction** techniques or using fast **free-breathing** scans, quality images can be obtained even when there is motion.

Other appealing options include using sequences with reduced acoustic noise and the option to offer a needle-free exam through use of high-quality contrast-free scan protocols. A child that is able to stay still during the examination, will not need sedation. Avoiding sedation or general anesthesia makes the procedure easier and avoids associated risks.

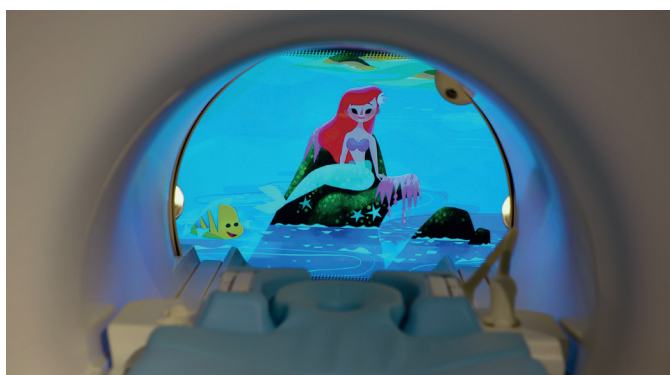
Preparing children in a playful way

Philips **Pediatric Coaching** is a holistic solution designed to de-stress the patient and parent experience for children undergoing an MRI scan. Proven educational techniques, like gamification and buddy system, prepare children and their parents beforehand using a mobile app at home and an educational KittenScanner toy in the hospital's waiting room.

And when it is time to have the scan, the child is again accompanied in-the-bore of the scanner by the buddy character Ollie, whose familiar voice guides them throughout the examination.



Philips and Disney join forces to improve the healthcare experience for children



Philips **Ambient Experience** creates an engaging, multi-sensorial imaging environment that is welcoming and relaxing. Children can personalize the room's lighting, video, and sound by selecting a theme of their choice. During the scan the audiovisual experience helps patients relax and minimize motion.

As **announced** in March 2021, Philips has partnered with European Hospitals to conduct a clinical research pilot program that aims to help reduce fear and anxiety during MRI exams to improve children's patient experience. The study will explore the effects and use of animated stories and characters, including some of Disney's most beloved characters – created specially by Disney animators for use in hospitals with clinical guidance from Philips.

“With this pilot study, we will investigate the impact of Philips Ambient Experience including Disney's specially developed themes to empower children with a positive experience to help them throughout the medical procedure. Together, we can make a real difference for thousands of young patients going through medical procedures each day.”

Kees Wesdorp,
Chief Business Leader of Precision Diagnosis at Philips

For more than 130 years, we have been creating meaningful innovations to improve people's lives and make the world more sustainable.

We are inspired to continually advance the state of precision diagnosis with customer- and patient-centric solutions that deliver clear care pathways and confident outcomes.

In MR, our mission is to achieve a fast, fully automated, and personalized exam for every patient, while acting responsibly towards our planet and society.

With AI-driven* smart connected imaging, optimized workflows, and integrated clinical solutions, we improve your MR department's productivity, enhance patient and staff experience, and deliver high quality diagnostic outcomes.

* According to the definition of AI from the EU High-Level Expert Group



Helping the multitasking MR technologist

Improving MR operation to benefit staff, patient, and productivity

Imaging services are under constant pressure to respond to growing demand, shrinking budgets, system complexity, staff shortages, possible burnout, and COVID-19-related restrictions and requirements. In MRI, the technologists are at the center of operation; they are key to a successful high quality service and are critically valued by patients and referrers. Specific pain points experienced by MRI technologists emphasize the need for new approaches.

Read about daily operation experiences with existing and envisioned solutions to support technologists and benefit imaging departments. ►



Kris Giordano

Imaging Director at RWJ Barnabas Health. From 2011 to 2019 he was managing the MR section. He has been in the field of MR since 1995.

“Working past COVID-19, we’re tasked with an overabundance of patients, and I’ve been thinking a lot about what we can do to mitigate that burden.”

Technologists are at the center of MRI operation and have broad responsibilities

Technologists are in control of the MRI scanning process. Their duties seem ever-increasing and add to the pressure of always being up-to-date on the latest scanning techniques. Technologists must be well trained as well as knowledgeable about each patient's condition and the examination's purpose. They coach the patient and ensure patient safety. At the same time, they are expected to consistently produce high-quality images that allow radiologists to make a diagnosis.

Kris Giordano, Imaging Director at RWJ Barnabas Health in New Jersey, USA, says “About multitasking – I may not have enough time to truly describe the life of the modern-day MR technologist. So many tasks are now the responsibility of the MR technologists. In addition to scanning and the day-in, day-out necessity of meeting the demands of the patients, there are always telephone calls from patients, from radiologists, from colleagues regarding certain patient applications or prescriptions.”

MRI technologists' tasks

Technologists are responsible for many tasks both behind the console and in the scanning room, and also including the safety and coaching of the patient before and during the exam. Losing focus during any one of these tasks could result in patient call-backs, incomplete exams, scheduling delays, and increased stress which impact patient care and results.



Out of room preparation including

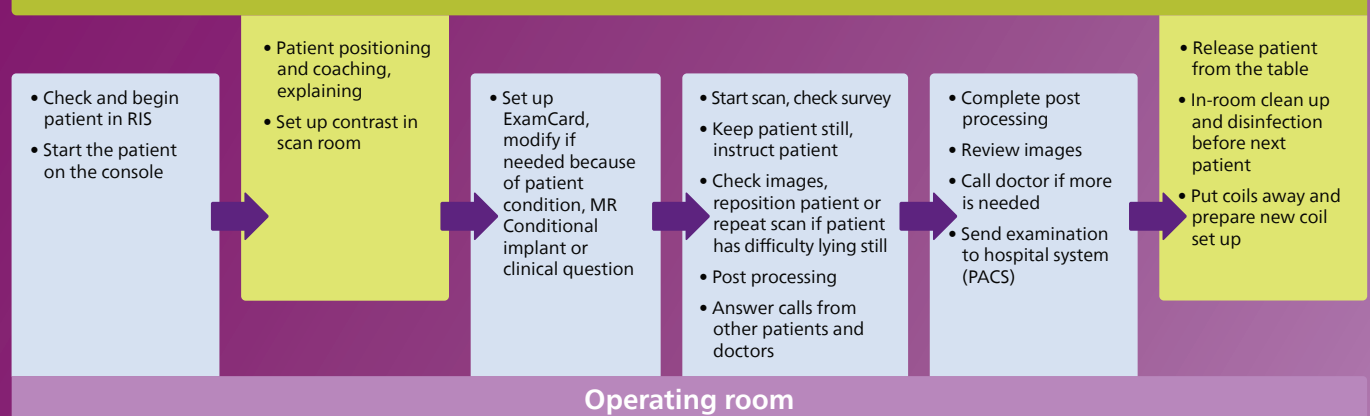
- Final safety check (metal, implants, other contraindications)
- IV setup, changing into gown
- Check patient ID and check that exam is correct

If patient has an implant, this has to be researched. For an MR Conditional implant, the scan conditions need to be retrieved from the implant's manufacturer.

If patient has a contraindication to contrast, medications may need to be given or bloodwork taken to assess kidney function.

If patient reports being a metal worker or welder, an orbital x-ray needs to be done before the MR

Scanner room



"At the same time, everything that we do has to center on quality and safety. We have to ensure that we provide reproducible diagnostic quality, essentially contributing towards diagnostic confidence for the clinician. And we need to meet that demand without compromising safety in any way."

COVID-19 has had substantial impact on role of technologists

In the past year, technologists' broad responsibilities have evolved to not only include MR safety, but also additional COVID-19-associated measures. In the 2020 IMV report, 77% of respondents indicate that MR technologists have to wear personal protection equipment (PPE) such as masks, face shields, gowns, and gloves.¹ The biggest change seen in MR operations was the cancellations and no-shows by MR outpatients due to fear of exposure to COVID and orders to remain at home.

"Since the COVID-19 outbreak, a main issue has been about reducing staff and patient anxiety," says Mr. Giordano. "We no longer have 30-minute time slots, but have increased these to a standard of 45 minutes, and 60 minutes for the longer procedures, to allot the appropriate time for the proper cleaning of the equipment. Also, as we are triaging patients into Zone 3, we're cleaning every room in front of them. We spray down the patient lockers and wipe the magnet in front of them. These tasks are costing us time, but are also instilling major confidence boosters in our patients."

"Reduction of staff anxiety has been our number one focus. We ensured that we had adequate PPE and training on the donning of PPE for all levels of staff, including the concierge at the desk, radiology nurses, technologists, and radiologists. Creating a safe environment for staff has allowed us to ensure employee engagement sufficient enough to overcome the many challenges we are facing."

Changing circumstances present new challenges

Imaging services operate with goals and boundaries in terms of financial outcome, number of procedures, quality and turnaround time of imaging and reporting, as well as patient satisfaction. Challenges can occur when declining reimbursements result in the need to scan more patients in order to break even. Further challenges may be associated with the COVID-19 pandemic, staff shortages, training and workload management, growing demand, long times between scan request and appointment, long times in waiting rooms for patients, and the need to be able to handle emergency cases in a timely manner.

"In general, we see that the demands for MRI are growing rapidly," says Kris Giordano. "Even the orthopedics use seems to be broadening, which can create growing demand. Also, in our current mode of working past COVID-19, we're tasked with an overabundance of patients, and I've been thinking a lot about what we can do to mitigate that burden."



"Since the COVID-19 outbreak, a main issue has been about reducing staff and patient anxiety."

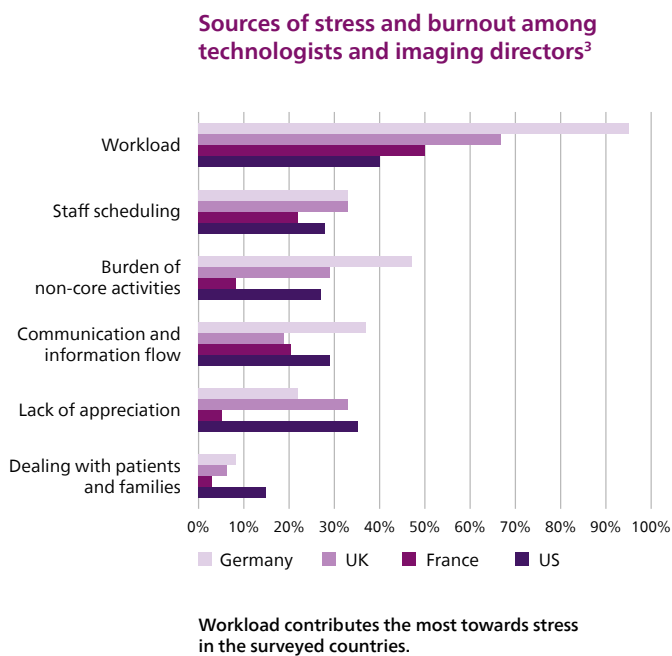
A growing population of patients with implants in particular require a substantial amount of attention from MR staff, who must first find out which implant the patient has, then find the MR scanning conditions from the implant manufacturer. Furthermore, setting up the scan to remain within these scanning conditions may require iterative adaptations of scan parameters. According to Mr. Giordano, "The collaborative team effort in researching MR implants really has been a major time crunch. This job alone, to complete that task prior to patient arrival, almost necessitates additional staffing."

Growing demands provide opportunities for business expansion, but may also increase the pressure on imaging department and staff. When demand increases because new MRI capabilities have become available, additional training for technologists will need to be scheduled. Some sites have begun to try to reduce patient waiting times by increasing scanning throughput.²

Satisfaction of patients and staff goes hand in hand

"There is no patient satisfaction without staff satisfaction," says Mr. Giordano. "So we must ensure that all levels of staff are happy and content in what they do. And especially now during this time of high anxiety and high pressure due to the pandemic, it is even more crucial than it ever was." ►

“We must ensure that all levels of staff are happy and content in what they do, especially now during this time of high anxiety and high pressure due to the pandemic.”



“This model of six per shift is great, but sometimes we are running into issues with staffing and coverage.”

Having a well-planned, well-managed patient schedule can benefit patients and technologists alike. It can allow the technologist to have more time to focus on the patient, which may in turn increase employee satisfaction.⁵

“Looking at options to improve both staff and patient satisfaction, we realized that one of our biggest issues are our wait times before start of the scan. We’re looking at ways to improve our management of patient delays and especially would like a more automated communicative measure to facilitate that better.”

Technologist overload affects department and patient

While technologists value their ability to provide excellent, patient-centered care, with a special focus on patient communication, their burden of responsibilities can detract from a technologist’s job satisfaction.^{3,4}

In a 2019 study, substantial numbers of technologists reported moderate or severe levels of job stress, most often associated with their workload.³ Also inefficiencies, overtime, patients arriving late and no-shows, all contribute to job-related stress.

The study revealed that technologists are often asked to do more, for example patient transport, or to support imaging needs for other departments, leaving them less time for their patients.³ Technologists are sometimes unable to stay on schedule, and often experience having reduced time or no time at all for breaks.³

What are the consequences? Stress and increased workload may lead to mistakes and errors, which in turn may lead to retakes, recalls or complaints. Recent data has shown that high numbers of imaging studies and the complexities of the imaging care continuum still create several risks, including errors in scanning procedures, increasing undue stress for the imaging staff.^{3,4} Reduced satisfaction and stress can also lead to burnout. Prolonged stress may also take a toll on the technologist’s mental health, resulting in the possible development of anxiety and depression symptoms.^{5,6}

Dynamics in the staffing model

In many countries, radiology department managers are facing growing demands in times where qualified technologists are hard to find. Determining the best staffing model can be an ongoing process.

“Having four scanners in our department, we usually have four technologists, one lead technologist or supervisor, and a radiology imaging nurse. This model of six per shift is great, but sometimes we are running into issues with staffing and coverage, so we rely pretty heavily on per diems in our modality,” says Kris Giordano. “I feel as though it’s inadequate, and we still need to have more people.”

Staffing is also influenced by the COVID-19 pandemic. “We’re looking at adding a technologist aide to help facilitate flow and help with the infection control mindset or even just helping out, for instance to help see a patient out or to help with navigating the building,” says Kris Giordano. “We have also seen a steep increase in cardiac MR, to the point where we’re looking at more facilitation, such as a post-processing software boost for our radiologists to expedite their read times. We’re really trying hard to meet the demands of today – yesterday is history for us, and we are assessing needs on a continual basis.”

Improvements helping to ease the strain on staff

Reliable automated processes and supportive tools present opportunity for gains in satisfaction and efficiency. The 2019 study shows that 23% of the imaging staff felt that almost a quarter of their work could be automated.³ It could allow technologists to multitask more easily, leading to higher throughput and resulting in more time for patients, which many of them desire.³ Increased levels of automation could

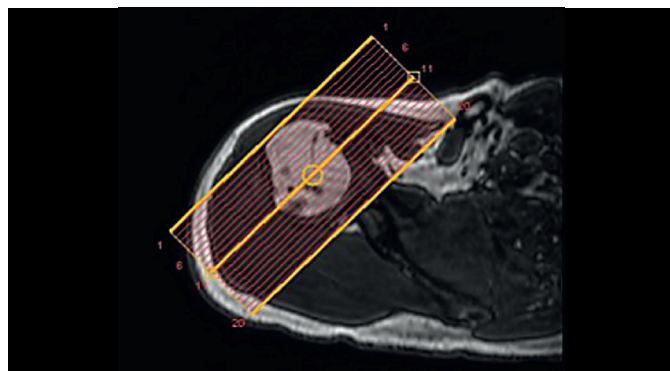
also lead to robustness of quality, which helps further ease the strain on radiologists.^{7,8}

In the past years Philips has introduced a whole range of automation and other workflow improvements, such as automatic patient centering in the MRI, touchless respiratory triggering, in-room exam start button, automated planning and scanning, in-bore visual guidance for breath holds and scan progress, automatic adjustments for patients with MR Conditional implants, automated post-processing. And more will be coming.

Automation can relieve need for training

Training and knowledge refreshers are essential for maintaining robust image quality and for ensuring patient safety. According to Kris Giordano, “Our technologists are fairly confident in the operation of the equipment. What helps is that our four MRI systems are all Philips, so they are similar in language and operation.” ►

Examples of automation in the operator room:



Automatic planning for consistent MRI results

After learning the operator’s positioning preference, SmartExam can automatically and reproducibly position the scanning area.

“SmartExam gives me the confidence that I can present consistently planned images to the radiologist. At every interval of repeat imaging a patient’s images look nearly identical. This reproducible planning is crucially important in oncology patients pre- and post-treatment, in MS patients and more – everywhere the goal is the same: consistent imaging plan, consistent image plane, reproducible image quality,” says Mr. Giordano.



Automatic adjustments for confidence with MR Conditional implants

In MRI of patients with MR Conditional implants the scanner can automatically adapt all sequences in the ExamCard to comply with the implant’s conditions after entering three parameters.

“The ScanWise software tremendously helps the technologist. It takes the guesswork and procedural adjustments out of the technologist’s hands and saves the time that the technologist would need for those adjustments. And on top of reducing time and number of clicks, it provides the confidence and peace of mind that we cannot exceed the limitations of the conditional implant – the scanner will keep parameters within bounds,” says Mr. Giordano.

Having Compressed SENSE allows for reduction of actual scanning time in most exams, can leave more time for technologists to attend to their tasks and their patient.

Automated technology, including on-screen guidance for technologists, can reduce the amount of training needed, boost technologist confidence, and reduce stress levels. "We feel that automation tremendously helps us, and helps us focus on quality and safety," says Kris Giordano.

Another observation is that technologists are multitasking on one monitor for scanning, post-processing and "filming". Access to the daily patient schedule, as well as some post-processing often require different systems.



Towards a smarter user experience

Could a smarter user experience improve imaging workflow and create better experiences for technologists, patients, radiologists?

At Philips, we envision progressing towards more integrated workflows for patient scheduling, image scanning, post-processing and analysis to support facilities that aim to reduce patient waiting time, improve overall efficiency and reduce time to results.

Simplifying the user interface, more automation and harmonization between modalities may be the way forward for addressing many of the issues mentioned by users. Such improvements could make rotation of staff between different

"We feel that automation tremendously helps us, and helps us focus on quality and safety."

scanners or modalities easier and shorten training time, while reducing the need for refresher courses.

"When I think back to how Philips MRI system operations have improved over the past decades, I have no doubt that the next versions will also lead to better efficiency. Over the years, we have seen large efficiency gains in our modality, and it doesn't seem to be slowing down in any way," says Mr. Giordano.



Change starts with measuring

The task of making big changes is often coupled with big challenges. However, in many cases, using an incremental step-by-step process to make changes may be more feasible – with or without applying a strict continuous improvement methodology. Implementing several small changes simultaneously is often an easier process, and allows for the evaluation of the effect of each individual change.

Measurements are needed, however, to ensure that the implemented changes lead to the desired improvement. This requires the determination of which measurable parameter will best reflect the desired benefit, and the proper timing of each measurement to ensure that enough data is collected to reflect both the “before” and “after” scenarios. The table below provides some ideas for useful parameters to measure in relation to the topics in this article. ■



**To measure is to know.
If you can not measure it,
you can not improve it.**

William Thomson, First Baron Kelvin,
British mathematical physicist and engineer (1824-1907)

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9. *Scanning patients with MR Conditional implants*. Philips FieldStrength 2015.
10. *Staff shortages in imaging departments causes stress among existing employees*. Radiology Business 2018.

Desired improvement	What to measure
Counteracting increasing patient wait time during the day (schedule drift)	<ul style="list-style-type: none">• Differences between appointment time and actual start of scan
Reducing technologists' overtime	<ul style="list-style-type: none">• Differences between scheduled and actual length of lunch break can be calculated from end of last scan before lunch to start of first scan after lunch• Differences between scheduled and actual end of shift time
Reducing training time	<ul style="list-style-type: none">• Amount of time spent on formal training• Frequency of instances where techs reach out to colleagues for scanning advice
Improving staff experience/satisfaction/confidence	<ul style="list-style-type: none">• Quality assessment via quarterly engagement surveys
Improving patient satisfaction	<ul style="list-style-type: none">• Patient survey including the net promotor score (NPS) question: Would you recommend our facility to others (indicate how likely on a scale from 1 to 10)



Ingenia Ambition brings consistent image quality, high resolution, and fantastic patient comfort to Altona Children's Hospital

A leap in pediatric MRI confidence at Altona Children's Hospital

For pediatric patients undergoing MRI at Altona Children's Hospital, the staff does what they can to get a confident diagnosis right away, in the first MRI exam. While the room lighting and the immersive in-bore audiovisual experience help their patients feel at ease, the experienced staff takes advantage of the features and capabilities of their recently acquired Ingenia Ambition scanner. The excellent image quality and the flexibility to adapt the exam to the findings, allows the staff to serve their very diverse patient group, from tiny newborns and toddlers to teenagers, very well.

Consistent image quality as top priority for children of every age and size

The Pediatric Radiology Department of Altona Children's Hospital in Hamburg, Germany, performs diagnostic imaging in pediatric patients, from newborns to patients of about 18 years of age, specializing in orthopedic, neurological, and gastroenterological imaging.

Dr. Carl-Martin Junge is the Chief Radiologist at the Pediatric Radiology Department. Since November 2019, the department has been using the Philips Ingenia Ambition 1.5T MRI system. Dr. Junge explains that the large range in age and size of pediatric patients, requires a broad set of MRI examination protocols. His first priority for an MRI scanner is good and consistent image quality, so that he is able to make

confident diagnoses in even the smallest and most difficult pediatric patients. In addition, their way of working requires an MRI scanner that offers a high degree of flexibility to allow tailoring of their imaging on the fly when initial findings give them a reason to do so. From day one of operation, the Ingenia Ambition has impressed Dr. Junge and his team with its powerful performance.

Overcoming challenges associated with pediatric imaging

Dr. Junge points out how scanning pediatric patients is more difficult than scanning adults. In addition to the small size, age range and often complex diagnoses, he mentions the challenges with keeping younger patients still in the scanner, during scans that often require 30 minutes or more.



Carl-Martin Junge, MD
Chief Radiologist, General and Pediatric Radiology at Altona Children's Hospital. He has more than 25 years of experience with MRI.



Frauke Meinken
MRI lead technologist at Altona Children's Hospital

"The in-bore features are key to successful examinations, especially for children"

"Essential to us are the consistent quality and resolution of the images, for every sequence."

"For children from zero to about five years old we use sedation to successfully carry out the examination. For patients from five to about 12-13 years, good coaching and the wonderful Ambient and in-bore features help keep the children calm in the machine and allow for good imaging. It's a very good advantage compared to other systems, I think. Older children can be treated similar to adults. Of course, motion-robust scan techniques help to address these challenges for all ages."

Dr. Junge estimates that per day, on average two or three patients out of ten would be scanned with sedation. MRI lead technologist Ms. Meinken adds that she has been happily surprised that the need for sedation was not affected when switching from an open system to a bore system – thanks to the fantastic in-bore and Ambient features.

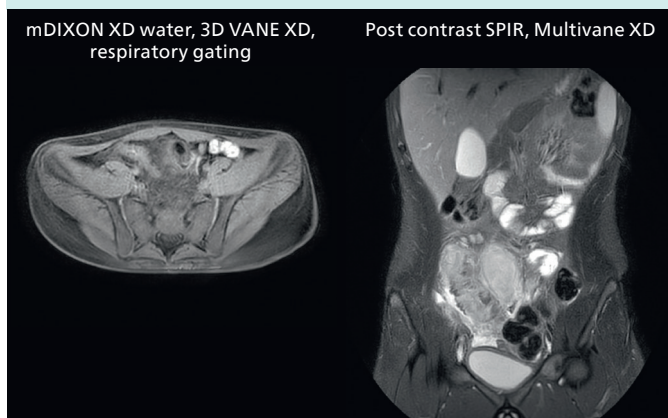
Another important factor is that many pediatric patients are still undiagnosed at the time of presentation, and the desire is to find a diagnosis immediately in the first exam, in order to limit or avoid the need for follow-up exams. As a consequence, the team needs flexibility and time during the examination.

Crohn's disease in the terminal ileum

A large abscess is visible near the terminal ileum, in the middle of the coronal image.

mDIXON XD water, 3D VANE XD, respiratory gating

Post contrast SPIR, Multivane XD



Patients and parents benefit from the many features designed for their comfort

Both Dr. Junge and Ms. Meinken value the patient-friendly attributes of the Ingenia Ambition. "The in-bore features, including music and videos to entertain the children during the scanning, are very useful," says Ms. Meinken. "The children really love this, it helps us persuade many of them. Without this, young children often do not want to enter the scanner, but with the films, music and color, they get interested and willing to undergo the scan. And we can take our time with the examinations, because the patients are distracted and at ease. I think, the in-bore features are key to successful examinations, especially for children."

"And the parents love it too," says Dr. Junge. "In addition, we can use noise reduction to make the scan more comfortable. Patients with spondylolisthesis or other painful afflictions particularly appreciate the special thick, soft mattress, which helps make their examinations much more comfortable. Many of these patients say it's fantastic, and they were never lying so comfortable in an MRI system before. I absolutely think that Ambition improves patient satisfaction."

"These capabilities also help the patients remain motionless inside the scanner, which allows us to obtain images with excellent quality," says Dr. Junge. "I think the in-bore Connect capability is one of the best highlights of this system."

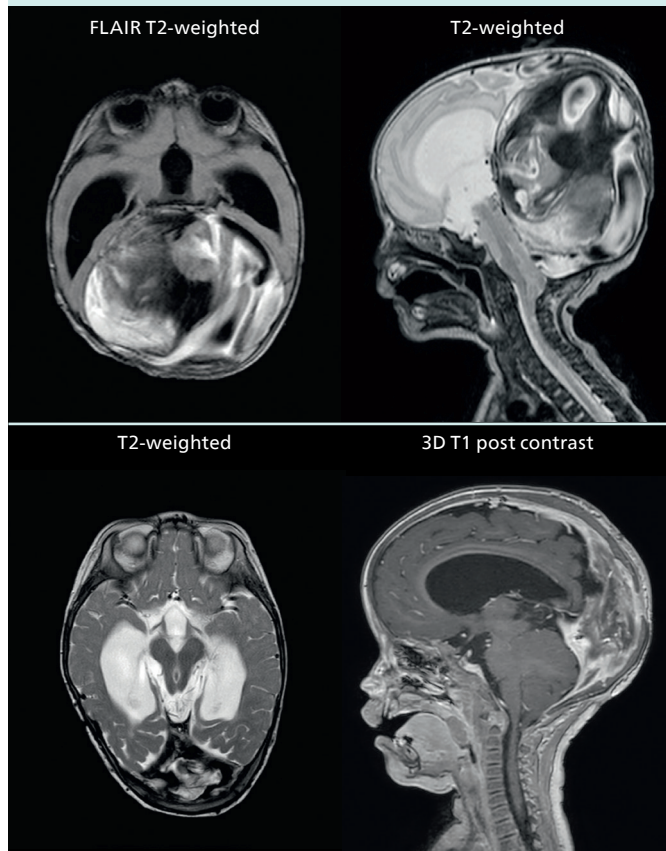
Ms. Meinken notes that the Ambient Experience also makes the atmosphere of the scanning room much more pleasant for the staff. "It's nice for the technologists to work in this friendly-feeling room. It feels much better than working in a dull, colorless room, as we did in the past," she says. ►

"It's nice for the technologists to work in this friendly-feeling room."

"We use this Compressed SENSE acceleration technology mainly for improving resolution without increasing scan time. We have already incorporated it into most of our ExamCards."

Dural sinus malformation (DSM)

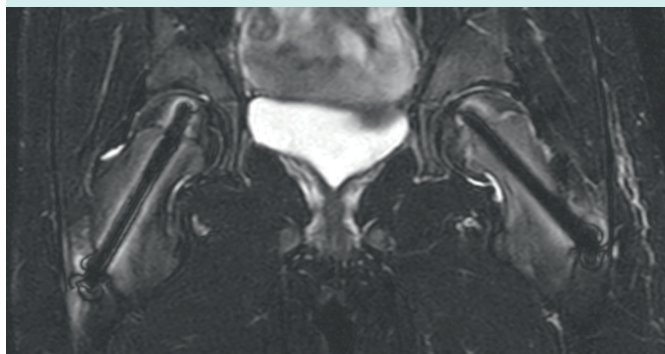
Initial examination (top) and after three times of coiling and acryl based embolization (bottom).



Slipped capital femoral epiphysis

After intervention with two cannulated titan screws, it is important to check that the circumference is normal and without necrosis. The screws can cause major metal artifacts, but O-MAR allows to improve visualization of tissue and bone in the near vicinity of MR Conditional orthopedic implants¹.

¹ Only for use with MR Safe or MR Conditional implants by strictly following the Instructions for Use



Achieving consistent high quality and high resolution

The MRI staff at Altona Children's Hospital always make sure there is enough time available to adequately scan each patient. "Throughput is not our priority, we take the time we need for every patient," says Dr. Junge. "Essential to us are the quality and resolution of the images, for every sequence. Ambition helps us achieve our primary goal of obtaining excellent quality images with high resolution – there is a world of difference with our old system."

Compressed SENSE is one of the most notable features. "We use this acceleration technology mainly for improving resolution without increasing scan time. We have already incorporated Compressed SENSE into most of our ExamCards," says Dr. Junge.

Since scan times of 3D scans can be significantly shortened thanks to Compressed SENSE, the MRI team is performing more 3D scans than before. "The advantage of 3D scanning is that we capture one high resolution sequence, but we can reconstruct images in any orientation, even after the scan, when looking at the images for diagnosis. Having this ability to view any cross-section we need in high resolution, can make re-scanning unnecessary," says Dr. Junge. "We are currently optimizing our routine head examination to include more 3D scans, including T1-weighted, T2-weighted and FLAIR."

The need to adapt exams in real-time

The ability to perform comprehensive MRI scans tailored to every patient is vitally important for Dr. Junge and his team. The pediatric patients that arrive for an MRI are often not yet diagnosed, and the MRI exam is the first imaging they undergo.

"We may not know exactly what and where we need to scan beforehand," says Dr. Junge. "During the examination – when seeing the first images – we may realize that we need to scan more anatomies or add different sequences in order to obtain all the relevant information immediately in the first exam. That is why we need flexibility during the exam. We constantly need to adapt our ExamCards as new clinical questions arise. We really appreciate how the Ambition allows us to change scan parameters quickly and easily; this is an extraordinary feature with Ambition, it's extremely useful, I think."

"Essential to us are the quality and resolution of the images, for every sequence"

“This flexible way of working – ExamCards for the routine scans and the possibility to change a parameter with one click – is a great benefit.”

Robust ExamCards with flexibility to tailor

Having a collection of dedicated ExamCards is important, as these are the starting points of MRI examinations. “We begin every examination with one of the ExamCards from our collection,” says Dr. Junge. “Then during the examination, as new clinical questions arise based on the initial findings, we adjust and add sequences. This flexible way of working – ExamCards for the routine scans and the possibility to change a parameter with one click – I think that’s an great benefit of Philips MRI scanners.”

“Our application specialist initially helped us make our set of ExamCards for pediatric targets, which we built by adjusting the ExamCards from the standard set of Ambition. Each ExamCard bundles the sequences for a specific examination. Currently, we are still developing more ExamCards for the different age and size categories of our pediatric patients.”

A leap in image quality thanks to progress in technology

The Ingenia Ambition gave Altona Children’s Hospital access to various novel scan techniques that are useful for pediatric imaging. “These modern technologies help us to scan anatomies where we saw challenges in the past, such as in the abdomen and thorax. With Ambition, we can perform high quality abdominal scans. As a result, the number of abdominal scans has increased substantially compared to our practice with our old system,” says Dr. Junge.

“We like to use the VitalEye feature in every abdominal examination. In my opinion it is an excellent trigger feature, and a big improvement from the respiratory belt we were using before,” says Dr. Junge.

“It was also a very pleasant surprise to us that we could get excellent resolution on other anatomies, as well, such as the spine, head, and knees, that we didn’t see previously. That is something that helps us tremendously as anatomy of children can be very small.”

Features that provide remarkable benefits to Dr. Junge include Compressed SENSE, which allows to elevate spatial resolution, signal and scan time. MultiVane XD and 3D VANE XD employ radial k-space sampling and help to mitigate motion artifacts and improve robustness for different contrasts and for all age groups. The mDIXON FFE and mDIXON TSE methods nicely address challenges in fat-free imaging and provide multiple



Compressed SENSE

is an acceleration technology that allows to **reduce scan time** or to **increase spatial resolution** within the same scan time

Neuro oncology Basic ExamCard	No Compressed SENSE	With Compressed SENSE
		-30%
Survey	25 min	17.5 min
Sag 3D T1w TFE		
3D FLAIR BrainVIEW aniso		
Sag 3D FLAIR BrainVIEW (optional)		
DWI b0 500 1000		
Cor T2w_TSE		
T2w_TSE		
Sag 3D T1w TFE GD		
3D T1w TSE GD		

contrast types from one single scan. The achievable large field of view (FOV), high resolution and flexible echo times are certainly a huge benefit in examining children.

Increasing the number of patients per day with Ambition

According to Dr. Junge, the department used to typically scan three or four patients per day with their previous system. However, this number instantly increased when they began using the Ambition. “Without much effort, we almost immediately doubled the number of patients to approximately six or eight per day,” says Dr. Junge. “We have only been using the system for three months and we plan to scan more patients in the future. I think our daily capacity can grow to ten or more patients per day.” ►

“We really appreciate how the Ambition allows us to change scan parameters quickly and easily; this is an extraordinary feature”

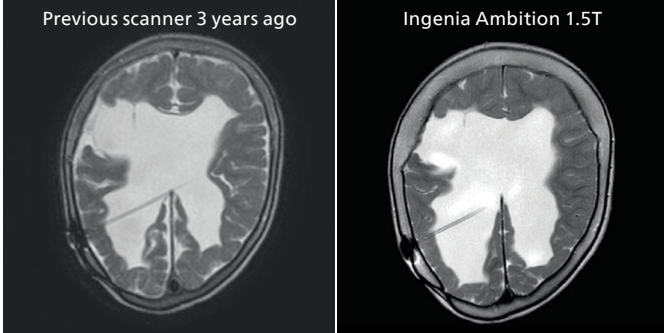
"We like to use VitalEye in every abdominal examination. In my opinion it is a big improvement from the respiratory belt we were using before."

Hydrocephalus post hemorrhagic

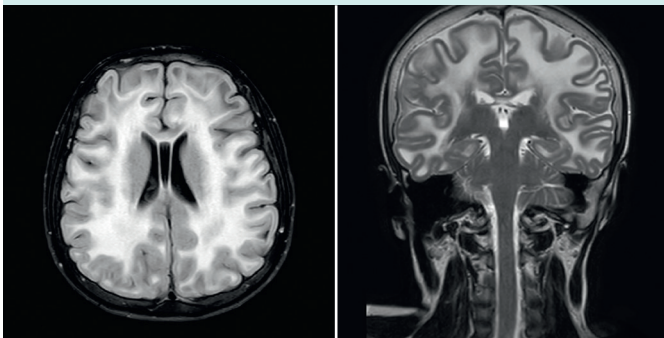
Both pictures show a ventriculoperitoneal shunt. With our previous scanner our hydrocephalus protocol needed about 25 min. With Ambition the examination time is about 14 min. including a CSF PCA sequence to show flow in the aqueduct.

Previous scanner 3 years ago

Ingenia Ambition 1.5T



Leukodystrophy in a teenager

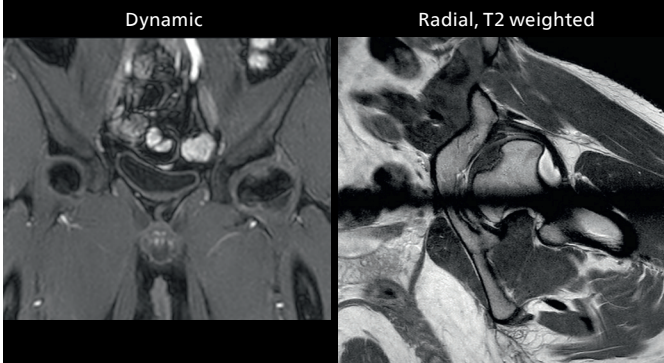


Perthes disease in left hip

The affected area on the upper circumference of the left hip shows contrast uptake in the dynamic scan. The radial scan nicely depicts the hip area, despite the dark shape in the center that is inherent to the radial way of scanning.

Dynamic

Radial, T2 weighted



Reasons to buy turned into expectations that are met

Several factors contributed to the purchase of the Ingenia Ambition system. "Excellent image quality and high resolution have always been the most important criteria for us. It has been amazing for us to see the image resolution and consistent quality that we can obtain with Compressed SENSE throughout the body," Dr. Junge says. "Also the mDIXON images are fantastic, and 3D VANE and other features as well."

"Our workflow benefits from the fact that our collection of dedicated ExamCards help us start a pediatric exam quickly and consistently. At the same time the scanner allows us to modify the parameters and sequences when we discover during the exam that a clinical question requires that. For patient satisfaction, the most impressive feature is the experience in the bore. That's absolutely the highlight of the machine."

Dr. Junge also commented on the fully sealed magnet which contains only 7 liters of helium. "No helium can escape from the magnet, so no refills are needed, which represents a nice cost saving," says Dr. Junge. The risk of a quench – with its associated disruptions and cost – is also eliminated.

Meeting pediatric imaging goals with Ambition capabilities

To conclude, Dr. Junge reiterates that the Ingenia Ambition with its unique magnet technology provides excellent scanning features as well as patient comfort. "Our young patients are surprised and fascinated by the Ambient room and the in-bore experience, which helps them undergo the examination," he says. "This is key for successful pediatric examinations. However, most outstanding for me are the many features for obtaining high-end pictures with an 1.5T system."

"For a good diagnosis, we often need to look at multiple anatomies with several diagnostic possibilities and make adjustments during the scan. This can be challenging, but the Ambition provides us with great features, easy operation and high flexibility for obtaining high quality, comprehensive imaging in our pediatric patient population that covers a wide range of age, size and clinical indications. And besides, from day one, we also scan more patients than with our previous system." ■

"Without much effort, we almost immediately doubled the number of patients per day"



Summary of experiences with Ingenia Ambition at Altona Children's Hospital:

- Latest advances in imaging capabilities consistently provide excellent image quality
- Use of Compressed SENSE helps obtain high spatial resolution without increasing scan time
- The speed offered by Compressed SENSE allows to include more 3D sequences that allow reconstructed in any orientation
- Robust ExamCards in combination with flexibility to tailor during the exam are ideal for achieving a confident diagnosis right in the first exam
- Ambient lighting and immersive audiovisual in-bore experience are key for successful pediatric examinations
- From day one, more patients are scanned per day with Ambition than with previous systems
- Helium free operation saves cost and gives peace of mind

"It has been amazing for us to see the image resolution and quality that we can obtain with Compressed SENSE throughout the body. Also the mDIXON images are fantastic, and 3D VANE and other features as well."

Dedicated pediatric oncology ExamCards

An extensive set of dedicated pediatric ExamCards was developed in a collaboration with some expert users in Germany and based on the guideline from the European Society for Pediatric Oncology Brain Tumor Imaging Group (Nov 2017) and consensus of 11 German Philips MRI users (March 2019). Some highlights are:

- Age-matched, neuro-oncology and body-oncology ExamCards, both for 1.5T and 3.0T
- Meeting different clinical needs: basic, CE- and non-CE-MRA, dynamic contrast scans
- Scenarios with or without contrast agent and with or without respiratory motion compensation
- Available for different field strengths, coils and software releases (R5.3 and above)
- Compressed SENSE (C-SENSE) included to reduce total examination scan time by up to 30%
- Using latest techniques such as 3D VANE XD for free-breathing abdominal imaging, MultiVane XD for motion-free imaging in short scan time, mDIXON for excellent fat-free imaging.



Download these ExamCards, at www.philips.com/fieldstrength

Examples of a set of ExamCards for a selected age group. The list of sequences from the highlighted ExamCard is shown on the right. These ExamCards are part of the Philips DACH Pediatric Reference Scan Protocols

3.0T Neuro-oncology: ExamCards for child over 2 yo

Child over 2yo	Basic CSENSE
Basic	Survey
Basic CSENSE	Sag 3D_T1w_TFE nati... Sa
Basic 15ch	DWI_b0_500_1000 Tr
Basic 15ch CSENSE	3D_FLAIR_BrainVIEW... Tra
CE Angio CSENSE	Cor T2w_TSE CS Cor
NonCE Angio CSENSE	T2w_TSE CS Tra
Advanced	Gd Sag 3D_T1w_TFE CS Sa
Optional	Gd 3D_T1w_TSE_BB... Tra
Optional CSENSE	

Example ExamCards for child under 8 yo

Child 3mm under 8yo	Basic Gd
Basic	SURVEY
Basic no RTrig	Cor STIR_MVXD_RT cor
Basic Gd	T1w_FFE_MVXD tra
Basic Gd no RTrig	T2w_MVXD_RT tra1
Neuroblastoma	T2w_MVXD_RT tra2
Neuroblastoma no RTrig	Cor DWBS_b100_800 D...
Dynamic	Gd 3D_T1w_mDix_BH tra1
Optional	Gd 3D_T1w_mDix_BH tra2
Advanced	Gd Cor 3D_T1w_mDix... cor

Fetal cardiac MR made possible with ultrasound gating device

MRI becoming a realistic option in prenatal diagnosis of cardiac disease

The possibility to obtain a reliable fetal cardiac gating signal presents the exiting opportunity to perform robust fetal cardiac MR as an additional means for fetal congenital heart disease diagnosis. For example, when fetal cardiac echocardiography is inconclusive, MRI studies of heart anatomy and function can provide valuable information to aid in prenatal diagnosis and in preparing for surgery after delivery. Previously, fetal cardiac gating was not available, but the recently developed Doppler ultrasound MR gating device now facilitates gated fetal cardiac MR studies. The gating device is compatible with Philips MRI scanners and connects wirelessly, without need for special software installation. It may also be used for adult and pediatric cardiac triggered scans.



“The direct gating with ultrasound will be a game changer for the clinical use of fetal cardiac MRI.”

Mike Seed, The Hospital for Sick Children, Toronto

“The fetal cardiac gating allows us to obtain MR images of the fetal heart with good diagnostic quality.”

Dr. Vanessa Berger-Kulemann, Radiology specialist

Fetal cardiac MR imaging with smart-sync

The exciting alternative option of using Doppler ultrasound for MR cardiac gating allows to synchronize MR image acquisition with the fetal cardiac rhythm in a way that was previously not possible. Without this synchronization, motion artifacts typically render cardiac MR images useless for diagnosis.

Typically, cardiac MR utilizes either electrocardiography (ECG) or vectorcardiography (VCG) techniques to synchronize MR acquisition with the heart rhythm to “freeze” heart motion. Both methods require the attachment of electrodes to the patient’s skin, which makes the approach unsuitable for fetal cardiac imaging.

The recently introduced Doppler ultrasound device for gating, smart-sync, was developed by northh medical GmbH in Germany, in collaboration with Philips and clinical collaborators. This device can detect the heartbeat during MRI acquisition, and sends a gating signal to the scanner. This allows for the synchronization of MR data acquisition with the fetal heartbeat, resulting in fetal cardiac MR images of diagnostic quality. It allows for the use of standard cardiac sequences, so that acquired images instantly appear on the screen, allowing for immediate evaluation of slice positioning and quality – an important feature that allows for adjustments should the fetus change position.

High image quality can be obtained for morphological images as well as 2D and 4D blood flow measurements, in a normal clinical setting. Together with the acquisition speed of the Philips Compressed SENSE method, fast and well-directed imaging of the fetal heart and flow can be performed, opening up a new avenue for congenital heart disease diagnosis before birth.

The ultrasound-based trigger signal is reliable and easy to use due to its wireless connection. The signal also remains undistorted by the MR field, unlike ECG and VCG methods, and eliminates the need to attach electrodes to the skin. The positioning of the smart-sync probe is quite simple, only requiring the proper placement above the fetal heart. ►



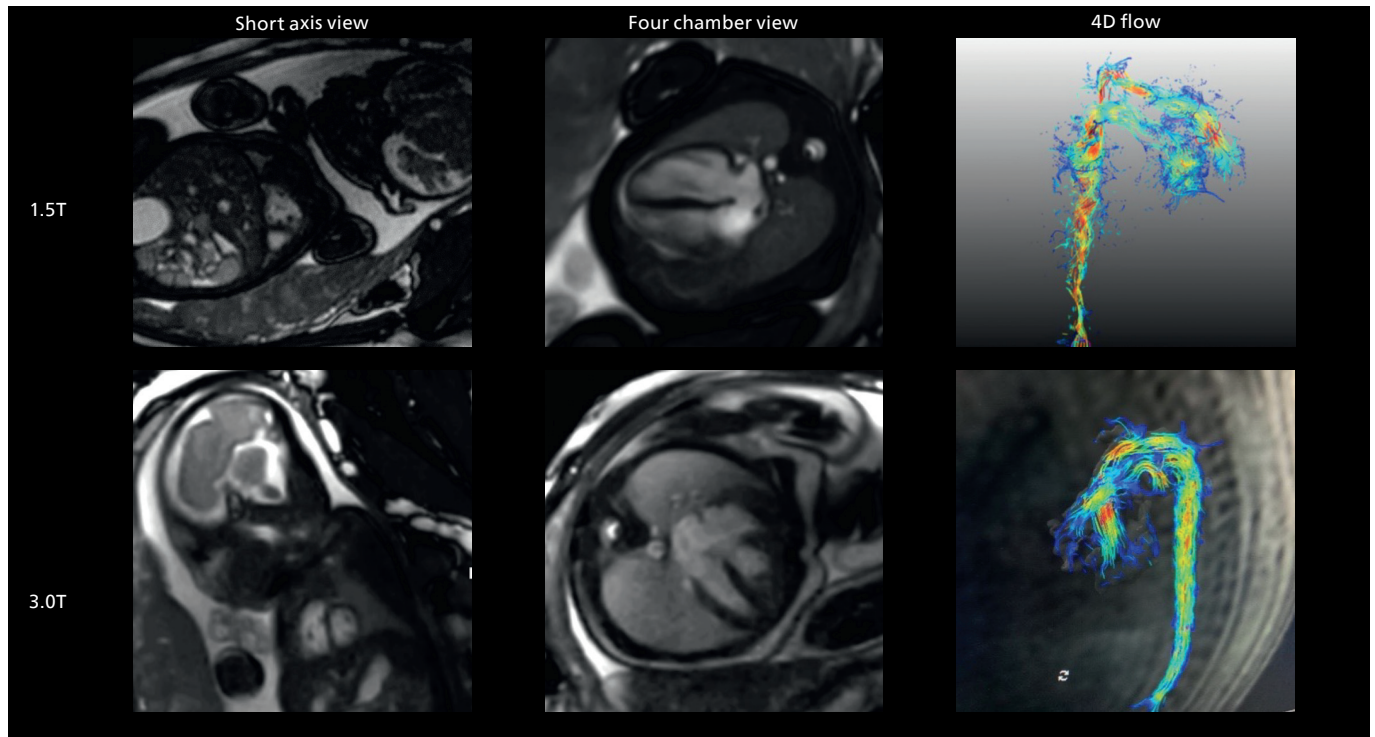
The transducer is fixed with a belt at the position where the fetal heart signal is strongest. The signal of the beating fetal heart is shown on the display and transferred wirelessly to the user interface.



Fetal cardiac imaging with standard cardiac MR sequences

These sequences allow for immediate assessment of acquired images:

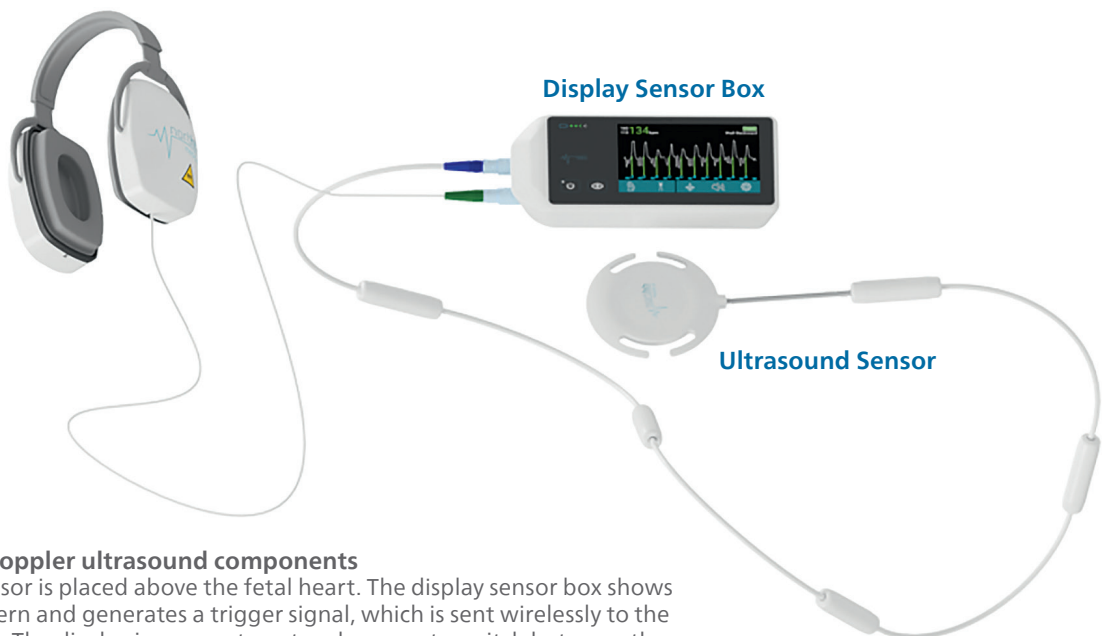
- SSFP cine: assessment of cardiac function and morphology
- PC flow: 2D measurement of blood flow
- 4D flow: assessment of the aorta and great vessels
- T1/T2 mapping: characterization of the cardiac tissue



Fetal cardiac imaging examples, gestational age 33-36 weeks.

“Smart-sync provides the cardiac gating signal that is necessary to run standard cardiovascular MR sequences with diagnostic quality.”

PD Dr. Björn Schönnagel, Radiology specialist



The smart-sync Doppler ultrasound components

The ultrasound sensor is placed above the fetal heart. The display sensor box shows the heartbeat pattern and generates a trigger signal, which is sent wirelessly to the Philips MRI scanner. The display incorporates a touch screen to switch between the fetal and adult application and to change settings. Headphones provide acoustic feedback to help with the proper positioning of the ultrasound sensor.

“We have incorporated fetal cardiac gating into our clinical fetal CMR program, helping us in diagnosis of cardiac malformation in cases where fetal echocardiography was inconclusive.”

Pediatric Radiologist in a European university hospital

A useful alternative for prenatal echocardiography

Typically, prenatal cardiac examinations are performed with ultrasound echocardiography. However, this technique can be limited in cases of late gestational age, due to calcification of the bone, fetal position, or a lack of amniotic fluid. In addition, echocardiography is highly observer-dependent and with no alternative methods for assessing inconclusive results.

However, since accurate prenatal diagnosis is closely associated with optimal postnatal outcomes, a first-time right diagnosis is highly desirable, especially in identifying cases of congenital heart defects. Therefore, the use of cardiac MR with smart-sync represents a long-awaited alternative for fetal ECG.

Cardiac MR in adults and children without need for electrodes

Smart-sync gating can also be used in cardiac MR examinations for adults and children. It offers an undisturbed trigger signal, even at high fields, and eliminates the need for the unwieldy positioning of the adhesive electrodes on the patient's chest. Conversely, conventional ECG/VCG is patient-dependent, is prone to electric field errors, and susceptible to arrhythmia, which particularly affects image acquisition in diastole, where the required delay can only be predicted and not measured, resulting in inaccurate predictions of arrhythmic heart beats. In essence, smart-sync solves these issues by measuring actual blood flow and cardiac motion via ultrasound. This allows for the acquisition of high quality cardiac images, as well as use of high temporal and spatial resolution, with notable benefits for quantification and longitudinal studies. Trigger signals based on ultrasound can diminish the number of incorrect signals, and circumvent the need for repeating scans due to motion artifacts.

Wirelessly compatible with Philips MRI systems

Smart-sync can wirelessly connect to Philips 1.5T and 3.0T MRI systems, without the need for additional software. It has the potential to facilitate wide-scale availability of fetal cardiac MR. ■

References

1. Haris K et al. *Free-breathing fetal cardiac MRI with doppler ultrasound gating, compressed sensing, and motion compensation.* J Magn Reson Imaging 2020;51:260–72
2. Tavares de Sousa M et al. *Fetal dynamic magnetic resonance imaging using Doppler ultrasound gating for the assessment of the aortic isthmus: A feasibility study.* Acta Obstet Gynecol Scand 2020:1–7.

“The application of smart-sync for fetal cardiac MRI allows the translation of standard cardiac examination to the prenatal examination.”

Prof. Dr. Jin Yamamura, Radiology specialist

ExamCards for fetal cardiovascular MR with ultrasound gating device



Download these ExamCards, at
www.philips.com/fieldstrength

Visit the online article at www.philips.com/fieldstrength to download 1.5T and 3.0T ExamCards that include basic MR sequences for studying the morphology and function of a fetal heart, based on cardiac gating via the smart-sync Doppler ultrasound device. The ExamCards may be used to help users familiarize themselves with the technique, and can be easily integrated into clinical procedures.

The sequences are balanced for both spatial (1.0 to 1.4 mm) and temporal (approx. 15 ms) resolution to accommodate fetal cardiac anatomy and physiology. Compressed SENSE is included for scan time reduction.

These ExamCards are developed in collaboration with University Medical Center Hamburg-Eppendorf, Germany and Allgemeines Krankenhaus der Stadt Wien, Austria.



The power of MRI and MRI/US biopsy to aid in prostate cancer diagnosis



Edward Steiner, MD, FACR
Chief and Medical Director
WellSpan Advanced Prostate Care Center
York, Pennsylvania, USA



The power of multiparametric MRI is now not only recognized for exams to identify suspicious lesions, but also expands into guiding biopsies to inform a definite diagnosis.

Moving from TRUS biopsies to multiparametric MRI and targeted biopsies guided by fused MRI/ultrasound images benefits high-risk prostate cancer patients at WellSpan York Hospital

Radiologist Edward Steiner, MD, FACR, has collaborated with urologists to set up an alternative patient pathway for prostate carcinoma diagnosis via the use of multiparametric MRI and MRI/ultrasound fusion for targeted biopsies. Particularly when a patient with clinically significant prostate carcinoma had multiple negative TRUS biopsies before, this targeted procedure can help to quite quickly make a confident diagnosis, start therapy and potentially cure patients who have confined disease. This may be life-changing for the patient.

“Multiparametric MRI allows us to identify suspicious lesions and give these a PI-RADS score.”

Using MRI to help identify suspicious lesions in patients with suspected prostate cancer

WellSpan York Hospital, based in York, Pennsylvania, USA, is an advanced specialty care hospital. According to Dr. Steiner, the Chairman of Imaging, the hospital has been using multiparametric MRI and fused MRI/ultrasound image-guided biopsies in prostate cancer diagnosis since mid-2019. He has built a referral base within the five-county community surrounding York and northern Maryland regions.

“Contrary to other techniques, MRI allows for examination of the entire prostate gland with high soft-tissue contrast. Multiparametric MRI allows us to identify suspicious lesions and give these a PI-RADS score¹. For high-risk lesions, a biopsy can then be performed, guided by MRI images that are fused with ultrasound images in real time. This allows targeting of the lesions that were identified before.”

Advanced multiparametric MRI helps clinicians boost prostate cancer diagnosis

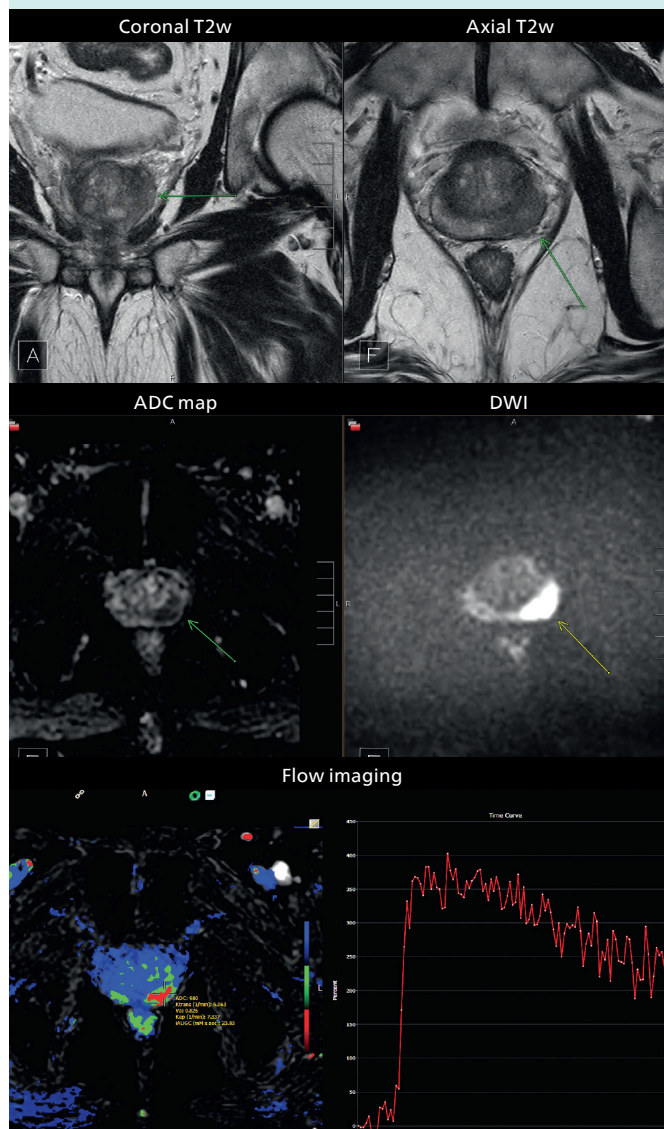
Dr. Steiner explains that techniques for prostate imaging and cancer diagnosis have not changed substantially in the past 30 years, despite the known limitations. PSA testing alone is usually insufficient and current TRUS biopsy techniques often miss anywhere from 40 to 50% of the gland². “PSA testing is imprecise and has a significant number of false positive as well as false negative tests,” he says. “It is, however, the accepted first path of entry for most patients that are ultimately diagnosed with prostate carcinoma.”

The use of MRI has significantly improved capabilities in prostate cancer diagnosis, according to Dr. Steiner. “Multiparametric prostate MRI allows us to look at three parameters to build our diagnosis on: conventional T1 and T2 signal intensity, diffusion-weighted imaging and ADC map, as well as dynamic flow imaging, to define the highest probability of prostate carcinoma.”

The standard PI-RADS system is then used to grade lesions based on the MRI findings. For PI-RADS 1 and 2, clinically significant cancer is (highly) unlikely. Intermediate PI-RADS 3 lesions represent a kind of diagnostic “grey area” – these lesions may become PI-RADS 4 lesions if they demonstrate a fusion restriction and a hypervascular tumor flow pattern or depending upon index of suspicion. PI-RADS 4 and 5 lesions have a statistically high chance of being a clinically significant prostate carcinoma and should be biopsied. Once biopsy is performed, the pathologists characterize the biopsy samples with either a Gleason score or an ISUP grade group³. ▶

Multiparametric MRI of a classic peripheral zone lesion

For lesions in the prostate’s peripheral zone, the DWI (diffusion weighted imaging) and ADC map are most helpful for our diagnoses. In this case, the DWI shows very bright signal, which indicates diffusion restriction. The arcuate area with significant signal drop out (arrow) on the ADC map is recognized as highly suspect for tumor. On the axial T2-weighted image the capsule contour looks a little irregular (arrow), which we interpret as capsular disruption and I usually give a measurement: this lesion shows larger than 1.5 cm capsular disruption. I don’t see any signs of lymphadenopathy, but interpret this lesion as PI-RADS 5. The hypervascular flow pattern in the bottom images adds to the diagnostic confidence.



To download Dr. Steiner's ExamCard for multiparametric MR of the prostate, visit the online article at www.philips.com/fieldstrength

“This process allows us to perform focal biopsies of suspicious areas based on PI-RADS categories that indicate the probability of an underlying potential malignancy.”

Predictable MRI patterns help identify suspicious lesions in the whole gland

Depending upon the Gleason score and prior therapies, prostate carcinoma has a certain predictable pattern on multiparametric MRI, according to Dr. Steiner. “In general, lesions in the peripheral zone have decreased T2-weighted signal and are relatively focal,” he says. “In the transitional zone, these lesions are more difficult to evaluate on T1 and T2, but are generally non-encapsulated.”

“We especially look at diffusion-weighted images and the ADC map. Prostate neoplasms generally have diffusion restriction, so they are bright on diffusion-weighted imaging and dark on an ADC map, which is one of the most important characteristics of neoplasms.”

“The third characteristic we look at, flow, is somewhat less specific but may be quite important in deciding whether a lesion is significant or insignificant. Prostate neoplasms often have a hypervascular tumor flow pattern, meaning that there is rapid inflow of blood into the lesion and then rapid outflow due to a disrupted capillary bed. This can be graphed on multi-parametric images, allowing us to define regions of interest and look at the actual flow within these regions.”

“I perform this interrogation using DynaCAD prostate, which also provides an easy way to determine PI-RADS score and create the report for the urologist.”

Using detailed, segmented MRI images to guide prostate biopsy

Dr. Steiner explains how a “blind” ultrasound biopsy may lead to a negative result, even when a tumor is present. “In a non-targeted biopsy guided by ultrasound, you see the needle and the confines of the prostate, but cannot see the tumor. So, when trying to get 12 cores as evenly distributed as possible, the tumor may still be missed, particularly when it is in the anterior gland, low in the apex or in other regions generally not easily biopsied by ultrasound.”

That is why Dr. Steiner has implemented the pathway where the MRI images can also be used to guide the biopsy. He uses an MR/ultrasound fusion guided biopsy system, UroNav, which

fuses pre-biopsy MRI images of the prostate with real-time ultrasound images during transrectal biopsy, for excellent delineation of the prostate and suspicious lesions, as well as clear visualization of the biopsy needle path.

“I felt strongly that the urologists are used to doing free-hand biopsies – their brain and hand are very used to manipulating the probe,” says Dr. Steiner. “What UroNav offers is no change in that workflow; it takes the diagnostic MRI images and the localized, segmented lesions and adds tracking and navigation to fuse that with the live ultrasound images. In this way, the MRI images can be used for targeting the lesion when performing the biopsy. The UroNav navigation sensor is mounted on the TRUS probe*, so for urologists the manipulation is similar to what they were used to.”

“This process allows us to perform focal biopsies of suspicious areas based on PI-RADS categories that indicate the probability of an underlying potential malignancy,” says Dr. Steiner. “As a result of the high confidence gained using this pathway, I have in the meanwhile limited my biopsies to fewer than ten and my goal, as I’m getting more comfortable with the process, is six or less,” he says.

From MRI to lesion segmentation to biopsy – an efficient process

For Dr. Steiner, DynaCAD is essential as a diagnostic tool for the interpretation of multi-parametric prostate MRI. “I have a custom layout that I’m comfortable with; it allows me to link all of the images and shows the T1, T2, diffusion-weighted images and ADC map on one screen. It also shows me the flow patterns on a second screen so that I can actually cross-link and read all of the images at the same time; I just scroll through the depth of the image,” says Dr. Steiner. “DynaCAD also has a PI-RADS module and I can actually annotate anything I dictate and have that as a report to show to the patient or the urologist.”

“We generate over 4500 images per case. Not utilizing an automated process would make interpretation quite difficult. Most people interpret prostate MRIs in a zonal manner, so we need a program such as DynaCAD that allows us to look at the flow pattern in basically one dataset.”



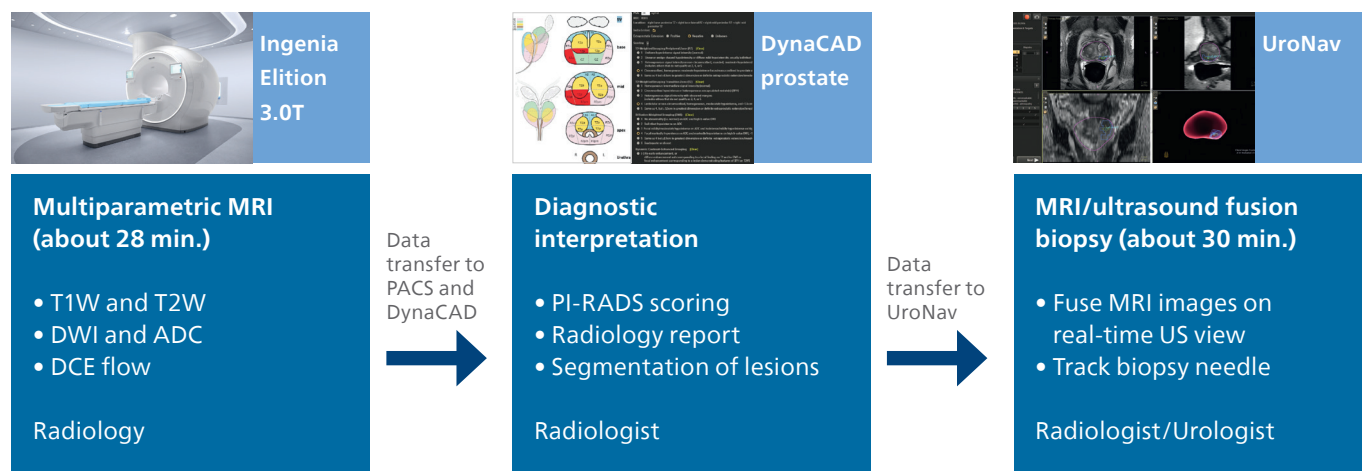
We generate over 4500 images per case. Not utilizing an automated process would make interpretation quite difficult.

“In this way, the MRI images can be used for targeting the lesion when performing the biopsy.”

*Contact Philips to ascertain compatibility with your system.

The alternative patient pathway for prostate cancer diagnosis:

Multiparametric MRI and MRI/ultrasound fusion biopsy



“We have been reimbursed for this entire procedure. When we can perform three to four biopsies a day, then our break-even is really rapid.”

If a urologist determines that a biopsy is necessary, Dr. Steiner uses the DynaCAD segmentation tool to define the prostate contour and the suspicious lesions in 3D. “This data is then sent to the UroNav and my technologist literally combines the real-time ultrasound image with the MRI data, so that the actual MR image is the live image that I’m seeing during the biopsy,” says Dr. Steiner. “Using UroNav, I can get a small lesion that requires biopsy. Performing this is quite like conventional ultrasound-guided transrectal biopsy; quite rapid, and to me, preferable over other methods. Biopsies take approximately 20 to 30 minutes”

Diagnostic results driving the use of fusion biopsies

Three years ago, Dr. Steiner found that urologists were still to be convinced of the value of MRI, and he made this his mission. He moved the prostate MRI to 3.0T and introduced the latest software level for both MRI and DynaCAD.

“Change often comes slowly, and positive results are really the only way we could implement change,” he says. “I initially lectured to regional urologists and radiation oncologists and asked them to send me a few challenging patients that had prior negative biopsies, but a high clinical suspicion of prostate carcinoma. Invariably, MRI findings and fusion biopsy led to

“DynaCAD also has a PI-RADS module and I can actually annotate anything I dictate and have that as a report to show to the patient or the urologist.”

immediate positive diagnosis of prostate carcinoma in this select population. That’s how we built up confidence. What happened is that the urologists then asked us to perform fusion biopsies on many of their patients.”

“I partnered with one of our local urology groups and we jointly did the first ten MRI fusion biopsies in our operating room, which gave us both experience as well as leadership. Having the UroNav capability added ‘GPS navigation’ to the urologist’s normal workflow and we could perform targeted biopsy. And I already owned DynaCAD, from which data could directly be imported to UroNav. It was a great win-win.”

Dr. Steiner points out that it is absolutely a benefit to have all of the capabilities – **Elition**, **DynaCAD**, **UroNav** – from the same vendor rather than having separate components from different vendors. “DynaCAD allows me to easily import the images into UroNav for eventual biopsy,” he says. “The decision for biopsy is taken after interpreting the MRI. So, if I don’t use DynaCAD/ UroNav I would have to import the data into another modality and literally need redo all of my work. That’s exactly what we did in my prior practice. No one liked to do it because of wasted time and there is reimbursement for one interpretation only.” ►



In our first 13 cases of repeat fusion biopsy following negative TRUS biopsy, 11 patients yielded positive tissue for clinically significant carcinoma.

According to Dr. Steiner, the adoption of MRI fusion biopsies came after several positive prostate cancer diagnoses using their new approach. "In our first 13 cases of repeat fusion biopsy following negative TRUS biopsy, 11 patients yielded positive tissue for clinically significant carcinoma; 92% of 48 targeted cores were positive in PI-RADS 4 and 5 lesions. The entire procedure takes less than 20 to 30 minutes and patients who have previously experienced a conventional transrectal ultrasound-guided biopsy often remark at how easy this procedure is."

"Since urologists were more likely to send patients to an interventional radiologist, we developed a solid referral base, since York Hospital was a Regional Medical Center," says Dr. Steiner. "I still work very closely with my initial urology colleagues and do all of their interpretation and segmentation, thus making this a mutually beneficial and noncompetitive environment."

Financial and health-related value associated with fusion biopsy procedure

According to Dr. Steiner, the MRI and fusion biopsy now have proven value. "I believe that utilizing these fusion biopsies in a problem-solving role and in selective patients has been incredible for our community. Patients with clinically significant prostate carcinoma that have had multiple negative biopsies get an immediate diagnosis, go to therapy, and can be potentially cured if they have confined disease. This fact alone saves lives and saves healthcare dollars."

"With Elition and Compressed SENSE we have decreased our scanning time from over 45 to about 25 to 28 minutes, with more patient comfort."

On the financial aspect, Dr. Steiner explains: "In South Central Pennsylvania, we have been reimbursed for this entire procedure: the diagnostic MRI, secondary segmentation charge prior to fusion biopsy, the technical and professional component of the biopsy, as well as reimbursement for anesthesia and OR time."

Initially the hospital started with leasing the equipment which has allowed to quickly break even regarding costs, according to Dr. Steiner. "The lease is very beneficial because it allowed us to get started with this procedure that involves both radiology and urology. We started clustering cases, because we're leasing the equipment per day. I have booked OR time up to twice a week and urologists also have the same OR time, so when we can perform three to four biopsies a day, then our break-even is really rapid."

Rapid scanning time and more patient comfort with Elition

Dr. Steiner currently performs all prostate MRI examinations on the Ingenia Elition 3.0T scanner. "Previously, our scans were over 45 minutes per patient. However, with Elition and **Compressed SENSE** we have now decreased our scanning time to approximately 25 to 28 minutes, with more patient comfort," says Dr. Steiner. "We have also achieved significantly improved resolution and more consistent parameters for interpretation. VitalEye, VitalScreen and other workflow features all add significantly to the patient experience as well as patient throughput."

"One of the big barriers of entry for prostate imaging has been that men do not like the discomfort of a rectal coil. Well, I can say whole-heartedly now, we do not need a rectal coil with our Elition 3.0T system and high quality gradients providing high quality imaging," says Dr. Steiner. "Additionally, the virtual immersive experience is excellent. Unprecedented comfort and decreased noise are possible."

"Many patients have had prior MRIs, which they disliked, because it's noisy, uncomfortable, boring, and the gantry is tight. And invariably, after we scan them in our Elition, most of them say, 'Hey, this wasn't as bad as I thought it was going to be.' I would say that patients are pleasantly surprised that the scan was quicker than they've experienced in the past; the immersive

Summary of Dr. Steiner's experiences:

- **High confidence** in identifying and segmenting suspicious prostate lesions with multiparametric MRI
- Multiparametric MRI allows **visualization of lesions** in prostate areas that can hardly be seen via transrectal ultrasound
- Patients needing prostate MRI are directed to **3.0T** as the high field strength benefits diagnostic confidence
- **Examination time reduced** from about 45 min. to about 28 min. thanks to Elition 3.0T with Compressed SENSE and excellent gradient technology
- **Patient comfort** features and **short exam time** with Elition are noticed and appreciated by patients
- DynaCAD prostate package allows fast and **easy data analysis and PI-RADS score** determination, as well as creating well-structured, comprehensive standardized reporting
- **Easy transfer of MRI data** – including segmentation – from DynaCAD to UroNav tool for targeted fusion biopsy
- Real-time **biopsy guidance by MRI images** fused to ultrasound by UroNav; probe handling quite similar to TRUS biopsy
- **Impressive results** seen with MRI/ultrasound fusion biopsies in patients with clinically significant prostate carcinoma that experienced multiple negative TRUS biopsies before
- **Entire procedure is reimbursed** and the biopsy setup allowed to quickly break even regarding costs



I would say that patients are pleasantly surprised that the scan was quicker than they've experienced in the past. The Elition is definitely a step up in terms of patient comfort and frankly, in imaging too.

experience is pleasant for them, and the bore seems more open than they remember. The Elition system is definitely a step up in terms of patient comfort and frankly in imaging too."

When asked if he would recommend 3.0T for prostate imaging, Dr. Steiner says: "Undoubtedly! When I look back at our prior scans that were done on a 1.5T, then the quality, the conspicuity of lesions and my diagnostic confidence are unquestionably improved with the Elition 3.0T. We had looked at all major vendors and selected Philips, because I thought Philips excels in technology as well as the ability to use ExamCards and the ability to cross-train our technologists."

MRI and MRI-guidance are part of the future of prostate cancer diagnosis

To conclude, Dr. Steiner emphasizes that the power of MRI is now recognized not only for multiparametric examinations to identify suspicious lesions, but also expands into guiding biopsies to inform a definite diagnosis.

"Patients that have PI-RADS 4 and 5 lesions on MRI have a high risk for clinically significant carcinoma. Such lesions are often in the anterior gland, low in the apex, or near regions generally not easily biopsied by ultrasound. These patients now receive MRI/ultrasound fusion biopsies, and this has been our standard of practice now for a year," says Dr. Steiner. "In my opinion, the combination of MRI and ultrasound fusion biopsy is extremely powerful. We will be doing more and more of these biopsies and scans for the future." ■

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A great fit for a small space in Hong Kong: Ingenia Prodiva* MRI

The compact features and lightweight magnet made Prodiva the ideal candidate for Causeway Bay clinic

The Centra MRI Centre, located in Causeway Bay, Hong Kong, is a newly opened, specialized imaging center, focusing mainly on musculoskeletal and neurological imaging. With prices for space at a premium in the city, the group at the center, including radiologist Dr. Chi Fai Lo and technologist Alan Tang, wanted to find a 1.5T MRI system that would not only produce excellent quality images, but also would fit within the limited facility space. Fortunately, Ingenia Prodiva's compact machine size and lightweight magnet made it an ideal candidate for the imaging center at Causeway Bay.





The MRI machine should meet the needs of the company, but also fit in the limited space.



Chi Fai Lo, MD

Radiologist and Director of Centra MRI Centre with 20 years of experience with his own private practice. His main field of work currently consists of musculoskeletal, neurological, and whole-body scanning.



Alan Tang

Technologist at the Centra MRI Centre, with more than 25 years of experience in imaging. His main duties include running the MRI Center, protocol and performance optimization, and training of junior staff.

Choosing a system when space is at a premium

In Hong Kong, location and manpower represent the main costs for any MRI business. Radiologist Dr. Chi Fai Lo says they saw an opportunity to start an MRI business in Hong Kong. In Causeway Bay, a vibrant center and major shopping district with not too much direct competition, they found an affordable spot at a good location. According to Dr. Lo and Mr. Tang, the small space of the facilities at Causeway Bay made it necessary to find a machine that would meet the needs of the company, but also fit in the limited space. Although other vendors had deemed the site too small to fit their 1.5T systems, it became clear that the Ingenia Prodiva MRI scanner would meet the needs of the available space. Its compact size and lightweight magnet were also beneficial when transporting the machine into its destination inside the building.

“The small size of the machine helped us a lot to fit this machine into our site.”



Centra MRI Centre in Hong Kong has three clinics in different locations. The most recently opened clinic in Causeway Bay, installed an Ingenia Prodiva 1.5T.

“The small size of the machine helped us a lot to fit this machine into our site. This has been the most important decision driver,” says Dr. Lo. According to Alan Tang, the minimal amount of noise generated by the Prodiva machine also keeps the business from disturbing neighbors who are squeezing into Hong Kong’s tiny living and working spaces nearby.

Coil flexibility, magnet homogeneity and mDIXON boost image quality

Other drivers of the decision to purchase the Prodiva system were imaging performance, cost and user friendliness.

“Since the system offers the possibility to combine two coils for simultaneous use, we felt no need to purchase additional dedicated coils,” says Dr. Lo. “And the flexibility of the coils allows the technologists to easily perform scans according to patient needs, regardless of the type of scan.”

Mr. Tang also noted how the homogeneity of the magnet helped optimize their protocols for imaging of extremities, such as hands, wrists, and feet, offering greater anatomical coverage during scanning. Fat saturation may represent a challenge in MRI of extremities but it’s excellent with Prodiva, said Mr. Tang. “Our traditional protocols couldn’t handle fat saturation very well. But the Prodiva has some protocols that are new for us, like **mDIXON**, which helped us overcome this problem.” ▶

“The minimal amount of noise generated by the Prodiva machine keeps the business from disturbing neighbors who are squeezing into Hong Kong’s tiny living and working spaces nearby.”

“Since the system offers the possibility to combine two coils for simultaneous use, we felt no need to purchase additional dedicated coils.”

Cost-effective scanning and maintenance with Prodiva

The team at the Causeway Bay clinic is striving to optimize their scanning and manpower capabilities, with the goal of scanning up to ten patients per day at the facility. Thanks to the design of the machine the site can operate without a separate room for the computer. And since the machine has low power use and does not generate much heat**, the facility saves money on air-conditioning and electrical costs. Dr. Lo also notes that the available service and engineering support contributed to the choice to purchase Prodiva, in order to cut down on machine down time and maintain throughput.

Prodiva features help optimize workflow

Though the facility is relatively new, the staff at the Causeway Bay clinic believe that having the Ingenia Prodiva will help them optimize their workflow and noted several features that are already helping them achieve this goal. According to Alan Tang, the automatic coil selection feature, where the scanner automatically determines which coil elements to use for scanning, saves them time. The integrated spine coil eliminates the need to change coil for each patient. “For example, we don’t need to take out the spine coil or other coils out of the machine for different patients. It’s very easy,” he says. “The possibility to combine multiple coils is also useful for performing whole body scans, and positioning is much easier for vascular and lower extremity imaging.”

Patient and physician satisfaction with Prodiva features

Although the space is small, the staff at the Causeway Bay clinic can still offer patients some privacy. “Because of the small size of the machine, patients can have some privacy in a separate waiting area, while waiting for their scans,” says Mr. Tang. “We can arrange the time slots for patients so that no other patients are waiting at the same time.”

Patients also seem comfortable with the Ingenia Prodiva. Mr. Tang notices that most patients don’t seem to feel as hot as he experienced with previous MRI systems he worked with. Dr. Lo says “So far, we have had positive feedback from patients, operators, and referring physicians. Patients are very satisfied with this machine.” ■



Summary of the experiences with Ingenia Prodiva at the Causeway Bay clinic:

- The compact size and lightweight magnet made Ingenia Prodiva the best fit for the MRI center at Causeway Bay
- The flexibility of the coil elements eliminates the need to purchase dedicated coils
- The homogeneity of the magnet and mDIXON allow for better imaging of extremities, including hands, wrists, and feet
- Patients, operators, and referral doctors are very satisfied with the Prodiva features and performance
- Helium free operation saves cost and gives peace of mind

“So far, we have had positive feedback from patients, operators, and referring physicians.”

*Formal registered name is Prodiva 1.5T CS/CX

**Compared to other Philips 1.5T MR systems

Results from case studies are not predictive of results in other cases. Results in other case may vary.



MRI boosts treatment quality and patient experience in radiotherapy

MRI streamlines workflow and attracts patients to private, single-linac radiotherapy center Hôpital de La Tour

In its ongoing mission to provide the highest quality patient care in the greater Geneva area, private healthcare provider Hôpital de La Tour (Switzerland) expanded its practice with a new oncology center offering medical oncology and radiotherapy services.

Physicist Grégory Bolard – who spearheaded establishment of the new radiotherapy department – was determined to make MRI accessible for precise radiotherapy planning for La Tour's radiotherapy patients. His team's ambition was to adopt MR simulation to better delineate targets and identify OARs, and to streamline the MR-based planning process via MR-only radiotherapy planning. La Tour radiation oncologists Dr. Champion and Dr. Breuneval report that their MR-RT workflows are paying off in improved contouring for radiotherapy plans and a fast simulation process for pelvic cases. ►



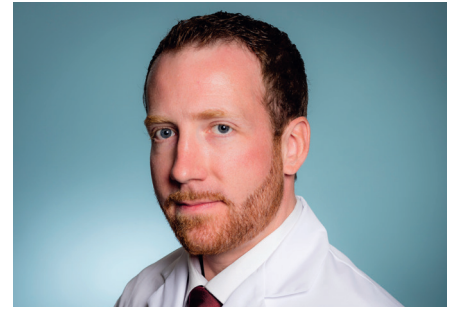
Gregory Bolard

Medical physicist at Hôpital de La Tour since August 2017. His current interests include workflow and treatment planning optimization as well as rising image quality for tumor delineation. In his previous position he pioneered the implementation of MR-only radiotherapy planning workflow for prostate cancer patients.



Ambroise Champion, MD

Radiation oncologist at Hôpital de La Tour. His clinical specialty areas include genitourinary, thoracic tumors and blood malignancy. He is also particularly interested in combined radiotherapy/hyperthermia and photobiomodulation treatments.



Thomas Breuneval, MD

Radiation oncologist at Hôpital de La Tour. His clinical specialty areas encompass breast and gastrointestinal cancers, as well as head and neck cancers including brain tumors management.

“La Tour’s administration and clinicians appreciated that MRI is a must-have for modern radiotherapy”

MRI in radiotherapy puts focus on patient comfort and outcomes

Mr. Bolard was hired to launch the entire radiotherapy department from the ground up: planning the physical space, putting the RT team in place and equipping the department with all necessary technology.

“With all high-end technology and treatment techniques at the linac’s side, we can target the radiation dose very accurately,” Mr. Bolard says. “But in many cases, target delineation is the largest uncertainty in the treatment process. To increase our confidence in the delineation steps, it was obvious that we should have access to an MRI simulator.

“La Tour’s administration and clinicians appreciated that MRI is a must-have for modern radiotherapy,” he says. “So, they agreed to acquire an MRI scanner – an Ingenia MR-RT – which would be shared between radiology and radiation therapy.” The radiotherapy department now offers MR simulation to all patients eligible and anatomies include brain, prostate, rectum, anal cancer, head/neck and gynecological cancers.

Shared service model secures access to MRI

The MR scanner is located in the adjacent radiology wing and the radiotherapy department receives two dedicated slots per week, amounting to three hours total for patients eligible for MR simulation.

“This is an ideal situation for us,” Mr. Bolard says. “With our patient load of about 300 patients each year, having our own MRI system was unrealistic. This shared-use model has made MRI economically affordable for us.”

“This shared-use model has made MRI economically affordable for us”

The collaboration between the two departments has been vital. “Clinicians in both departments appreciate the need for high quality imaging for RT planning and diagnostic purposes, and work together cooperatively to make that a reality,” Mr. Bolard says.

Detailed visualization of head-and-neck anatomy with MR-simulation

Integrating MRI in the radiotherapy workflow for our head-and-neck cancer patients was a logical step for La Tour’s new radiotherapy department, Mr. Bolard says.

“We have an excellent head-and-neck cancer program here that attracts many patient referrals from the larger Geneva region,” he says. “Our radiation oncologists decided to introduce MR-sim for head-and-neck cases to provide much more definitive soft tissue images than what CT can provide.”

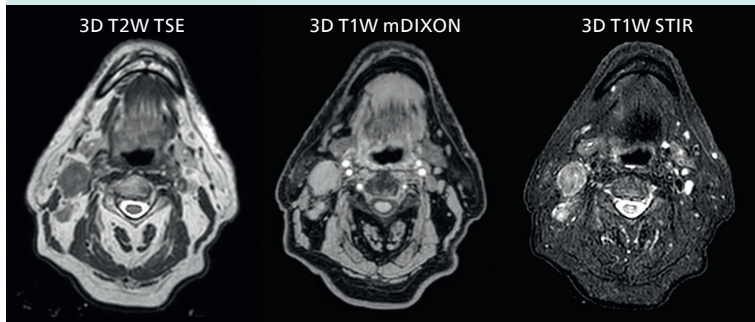
While CT clearly defines bone and cartilage, the modality’s limited soft tissue visualization makes head-and-neck structures often appear virtually indistinguishable from another. Co-registering an MRI dataset as a secondary information source for head-and-neck target and organ at risk (OAR) delineation is vital, according to La Tour’s Dr. Breuneval.

“MRI contributes substantially to visualizing head-and-neck lesions compared to CT and allows a better differentiation of normal from abnormal tissue,” he explains. “Tumor edges and extracapsular lymph node extension – as well as OARs, such as parotid glands, pharyngeal muscles and the brachial plexus – are better depicted. The resulting benefit is that tumor margins may be reduced and OARs better spared.” ▶

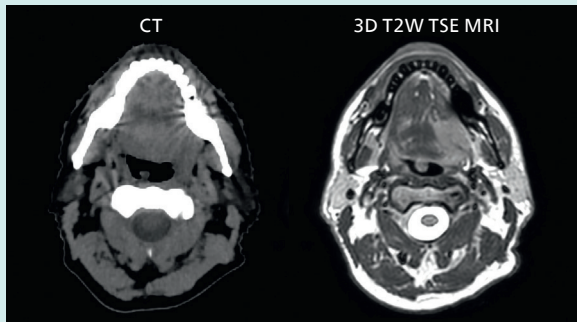
Epidermoid carcinoma of the left tongue base

The patient was diagnosed with an epidermoid carcinoma of the base of the left invading the amygdala lodge and the amygdaloglossal groove. Radiochemotherapy with curative aim was prescribed with a dose of 70 Gy for the tumor, 66 Gy on the suspicious nodes and 56 Gy on the elective drainage areas - in 33 fractions.

Simulation imaging

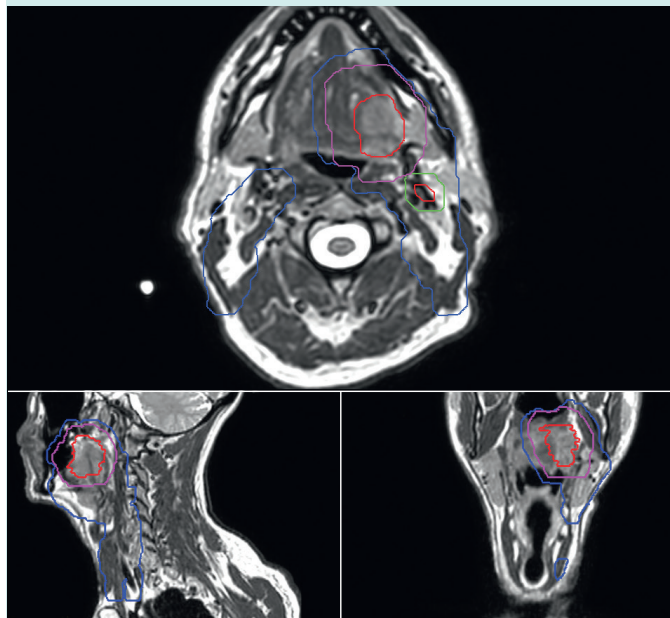


T2W 3D, 3D STIR and mDIXON MRI scans.

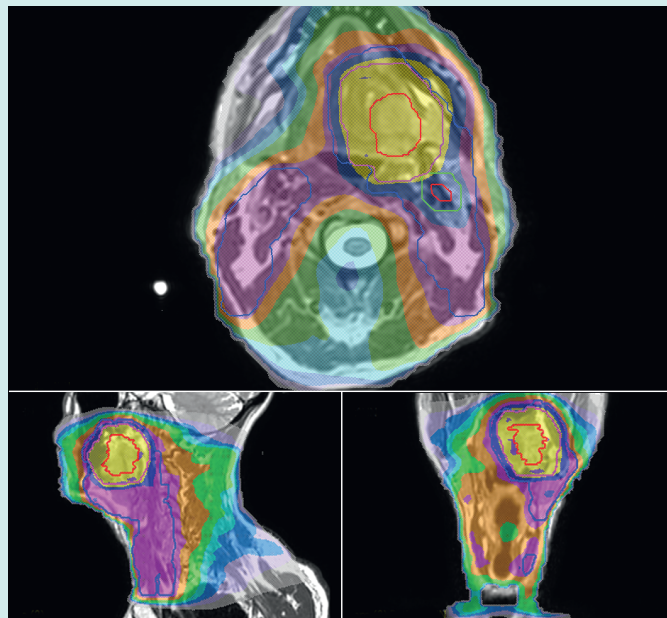


Comparison of CT simulation scan (left) and T2W 3D MRI (right)

MR-based contouring and planning



MR-based target contouring on 3D T2W TSE in transversal, sagittal and coronal planes.



Personalized VMAT dose planned in Philips Pinnacle.



To facilitate accurate CT-MRI co-registration, the La Tour team connects a 5-point CIVCO FreedomView thermoplastic mask directly onto the Philips couch top (left). The dStream Anterior coil and Flex L coils are used for high quality imaging (right).

"As a private institution we aim to offer both the best treatment and the best patient experience, MR-only radiotherapy makes so much sense in this respect"

MR-only radiotherapy planning drives a good patient experience

When MR-only radiotherapy planning is performed, no CT simulation of the patient is needed. Even from the start, there was no doubt that Hôpital de La Tour was going to provide MR-only radiotherapy planning for their pelvic cancer patients.

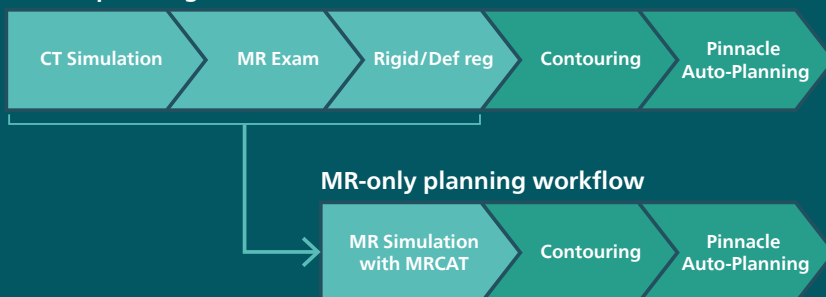
"As a private institution we aim to offer both the best treatment and the best patient experience," Mr. Bolard says. "MR-only radiotherapy makes so much sense in this respect. Referring physicians also totally appreciate the rationale for using MRI, as they are very familiar with MRI for diagnosis. And the fact that we can save the patient from undergoing multiple exams is a big advantage and a driver for patient referrals."

MR-only radiotherapy planning with MRCAT

Philips MRCAT (MR for Calculating ATtenuation) provides exceptional soft tissue contrast for target and OAR delineation, in addition to the Hounsfield units needed for dose calculations. This permits an MR-only radiotherapy planning workflow. Philips pioneered MR-only radiotherapy with the introduction of MRCAT Prostate, followed by the expansion to the whole pelvis with MRCAT Pelvis. This application can be used for a broad range of pelvic indications, including cancers in the prostate, rectum, bladder, anal canal and cervix. Next to MRCAT Pelvis, MRCAT Brain is available for radiotherapy planning of primary and metastatic soft-tissue tumors in the brain.

Reduction of workflow steps at Hôpital de La Tour

CT+MR planning workflow



MRCAT commissioning confirmed dosimetric accuracy

Before clinical use of MR-only radiotherapy planning, the team completed a commissioning project to confirm dosimetric accuracy of the MRCAT approach.

Dosimetric equivalence validation was performed on 43 patient cases by comparing MRCAT-based dose plans overlaid on CBCT image dataset and on the corresponding MRCAT image dataset. Mr. Bolard and Dr. Champion found good agreement between MRCAT-based and CT-based dose calculations, with a mean dose ratio of 1.007 (0.991-1.014). The 3D gamma score was greater than 95% (95.2-99.0%) for all plans checked³.

Simpler workflow, more confident pelvic contouring

The introduction of MR-only simulation for pelvic cancer radiotherapy planning has streamlined the workflow and increased confidence in target and OAR delineation, according to the La Tour team.

The simulation workflow is straightforward, with the RTT performing the positioning using the anterior coil support to prevent contact of the coil with the patient. No external laser positioning system is used. Instead, the La Tour team relies on the internal laser and a house-made ruler system for origin localization. Daily CBCT soft tissue matching against

the MRCAT image set is performed, leading to a lean and satisfying workflow.

"We save more than an hour-and-a-half in plan preparation as compared to a workflow where we would register CT with diagnostic MR series that are not designed to RT needs," Mr. Bolard notes. "We also increase accuracy, since typical diagnostic sequences use large slice thicknesses and limited FOVs, which makes registration difficult to perform."

The enhanced soft tissue visualization versus CT has made contouring much simpler, Dr. Champion adds. "MRI offers much better discrimination of the anatomical cleavage points, which improves contouring accuracy and reproducibility," he says. "For example, the erectile plexus and mesorectum are much better visualized on MRI than on CT. The same applies to the cranial limit of penile bulb, where we can more confidently spare this sensitive structure, thus minimizing the risk of radiation-induced erectile dysfunction. And, although the rectal and bladder walls can be well-visualized on CT, MRI provides finer definition."

"We save more than an hour-and-a-half in plan preparation"

“The erectile plexus and mesorectum are much better visualized on MRI than on CT. The same applies to the cranial limit of penile bulb, where we can more confidently spare this sensitive structure”

In addition to allowing easier contouring, MR-only radiotherapy potentially improves the long-term results of specific toxicities of radiation therapy, Dr. Champion adds.

“Moreover, it has direct consequences on the margins we apply to the prostate clinical target volume (CTV),” he says. “Teams working exclusively on CT scans usually use isotropic margins of seven to five millimeters, except for the back where the margin is five to four millimeters. With MRI support, we are comfortable using four-millimeter isotropic margins.”

Speeding up exams with Compressed SENSE

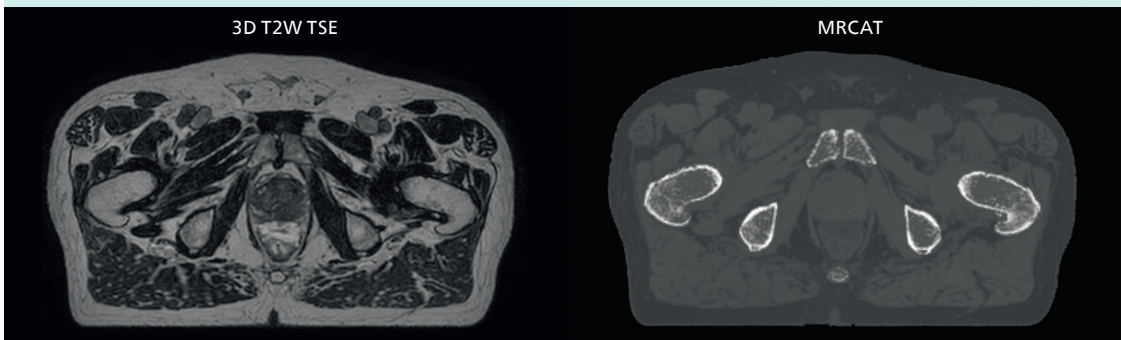
The Ingenia 1.5T MR-RT scanner is also equipped with Compressed SENSE, which helped the team to shorten scan times.

“Compressed SENSE accelerates our image acquisition by 20 to 40 percent to reduce the time needed per patient and therefore improves patient comfort and workflow efficiency with no change in image quality,” Dr. Breuneval says. “This benefits all our patients undergoing MR simulation. In particular for pelvic patients, – who must have an uncomfortably full bladder during their exam to improve visualization – this is a major benefit.” ►

Prostate MR-only radiotherapy planning with use of rectal spacer

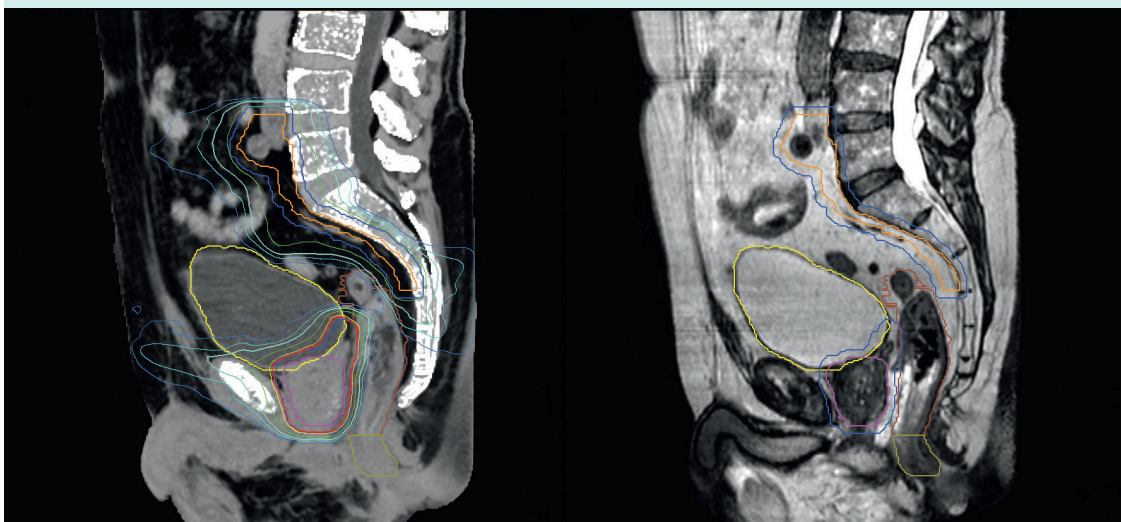
Hôpital de La Tour uses an implanted rectal spacer (SpaceOAR®, Boston Scientific) for patients receiving prostate radiotherapy to provide space between the rectum and prostate. 3D T2W TSE MRI provides excellent rectal spacer visualization and is used for OAR and target contouring. The dose plan is calculated on the MRCAT dataset.

Simulation imaging



Transversal 3D T2W TSE with Compressed SENSE, acquired on Ingenia MR-RT 1.5T (left). On-console generated MRCAT (right).

MR-based contouring and planning



MRCAT is primary image dataset for dose calculation (left). 3D T2W TSE MRI with 36 cm Field-of-View is used for delineation of prostate and organs at risk (right).



Summary of experiences with Ingenia MR-RT at Hôpital de La Tour

- Ingenia MR-RT provides superior soft-tissue contrast compared to CT for contouring to La Tour's radiation oncologists
- MRCAT Pelvis has simplified overall planning workflows and provided more confident pelvic contouring
- Compressed SENSE has helped the team to shorten scan times and improve patient comfort and workflow efficiency
- Ambient Experience in the MR room helps to decrease stress and anxiety for patients
- The shared-use model with Radiology has made MRI economically affordable

"Compressed SENSE improves patient comfort and workflow efficiency with no change in image quality"



MR-only simulation is a paradigm shift in radiotherapy planning and I foresee it becoming progressively more widespread globally.

MR-only radiotherapy provides advantages to patients, staff and workflows

Looking back on the last year of MRCAT Pelvis experience, Dr. Champion can point to several advantages for patients, staff and workflow efficiency.

"We have benefited not only from more precise tumor delineation and better OAR sparing, but also the elimination of the uncertainties of image fusion is particularly important," he says. "It is also clearer and simpler for patients, who are now prescribed a single appointment to prepare for their treatment."

"The logistical benefits are significant," Dr. Champion adds. "MR-only radiotherapy avoids the need for an additional imaging examination and also reduces the costs associated with treatment planning. It's also noteworthy that decreasing the number of examinations relieves the booking staff of these."

An image of the future

After having established MR-simulation as routine in their clinical practice, the team is committed to further expand their MR-only radiotherapy program to their brain cancer radiotherapy planning.

"MR-only simulation is a paradigm shift in radiotherapy planning. In the future I foresee it becoming progressively more widespread globally and feasible for more anatomical regions," Dr. Champion says. "We at Hôpital de La Tour are proud to be pioneers in this field to provide the highest level of patient care." ■

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"We have benefited not only from more precise tumor delineation and better OAR sparing, but also the elimination of the uncertainties of image fusion is particularly important"



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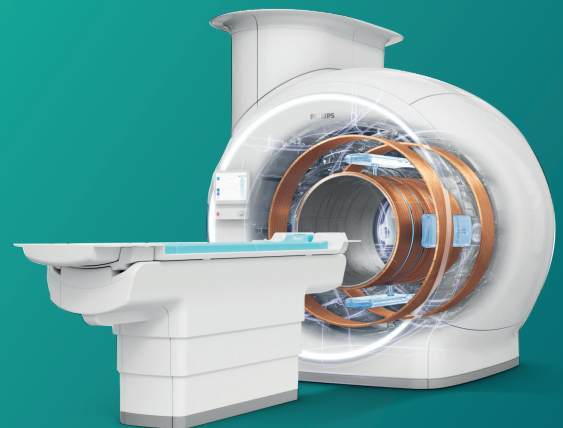
Ingenia Ambition 1.5T



The new reality in MR

In today's world, you may feel more pressure and uncertainty affecting your MR services. By freeing up your MR operations from potential helium complications, Philips Ingenia Ambition 1.5T can help you unlock your capacity to provide outstanding services to referring physicians and patients, reliably and productively. Perform your exams up to 50% faster¹ with Compressed SENSE and achieve a fast overall exam-time by a simplified patient handling at the bore with the touchless guided patient setup. This can lead to a better patient and staff experience. Just think what your new reality in MR could be.

innovation  you



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1. Compared to Philips scans without Compressed SENSE.