

# FieldStrength

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## Pediatric neuro imaging gets boost from Ingenia 3.0T

At Phoenix Children's Hospital, clinicians are seeing more detailed images and improved workflow



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## User experiences



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# Pediatric neuro imaging gets boost from Ingenia 3.0T

At Phoenix Children's Hospital, clinicians are seeing more detailed images and improved workflow

Phoenix Children's Hospital (Phoenix, Arizona, USA) is a large free-standing pediatric hospital, newly opened with more than 500 beds. A tertiary care referral center treating complex neurological, cardiovascular, hematological, gastrointestinal and MSK disorders, the hospital is supported by pediatric subspecialists in every major discipline. In addition to standard neuro imaging of the brain, neck and spine, it also offers fMRI, perfusion studies, diffusion tensor imaging and MR spectroscopy. The hospital has several Philips 1.5T scanners and installed [Ingenia 3.0T](#) in November 2011.

"We have scanned more than 700 patients on Ingenia, ranging from the evaluation of common neurological conditions such as headaches up to complex conditions such as epilepsy, tumors of the brain and spine and genetic and metabolic brain disorders," says Jeffrey H. Miller, MD, pediatric neuroradiologist. "We also routinely image patients following traumatic brain injuries and newborns with neonatal encephalopathy."

"Pediatric neuro MR is much different than MRI in adults," he explains. "We deal with all sizes of children, requiring modifications

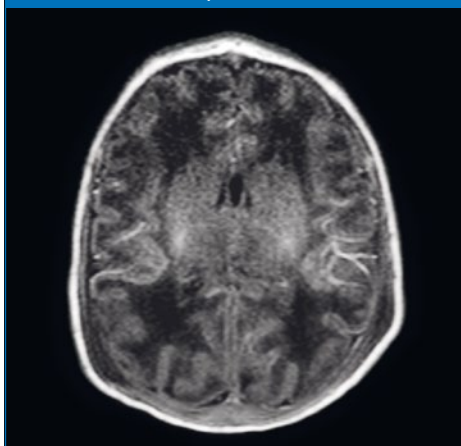
to several parameters such as FOV, voxel size and slice thickness. The conditions of many of these children are very complex, and require additional sequences, advanced imaging techniques and often repeated imaging to follow complex disease processes."

#### Advantages of high resolution

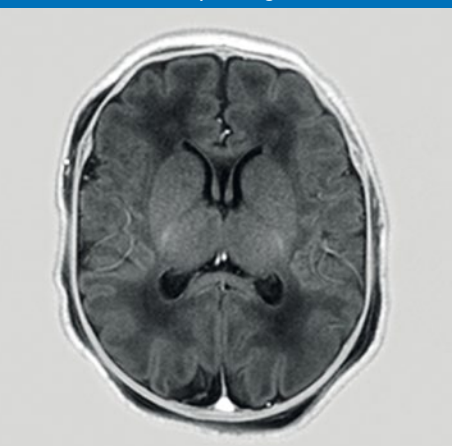
Dr. Miller says Ingenia's high-resolution imaging provides better delineation of subtle abnormalities, such as cortical malformations in patients with seizure disorders that may not be detectable at lower field strengths or in exams done with lower resolution imaging.

*"Our standard brain MRI exam now consists of very high-resolution 1 mm 3D T1 and no gap 2 mm axial T2 imaging."*

Neonate day 1 – Achieva 1.5T

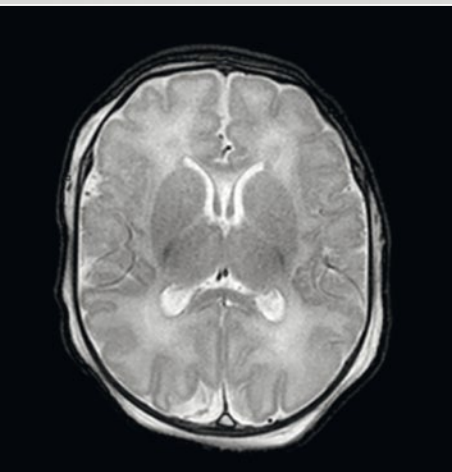
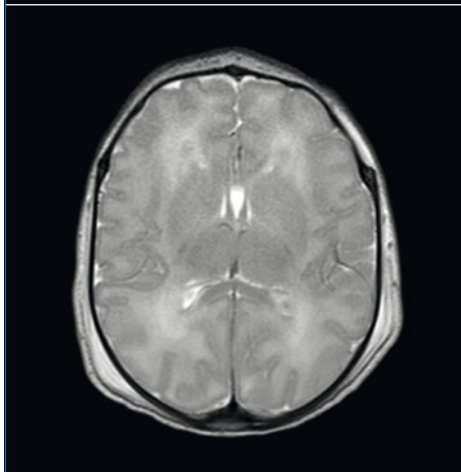


Neonate day 4 – Ingenia 3.0T

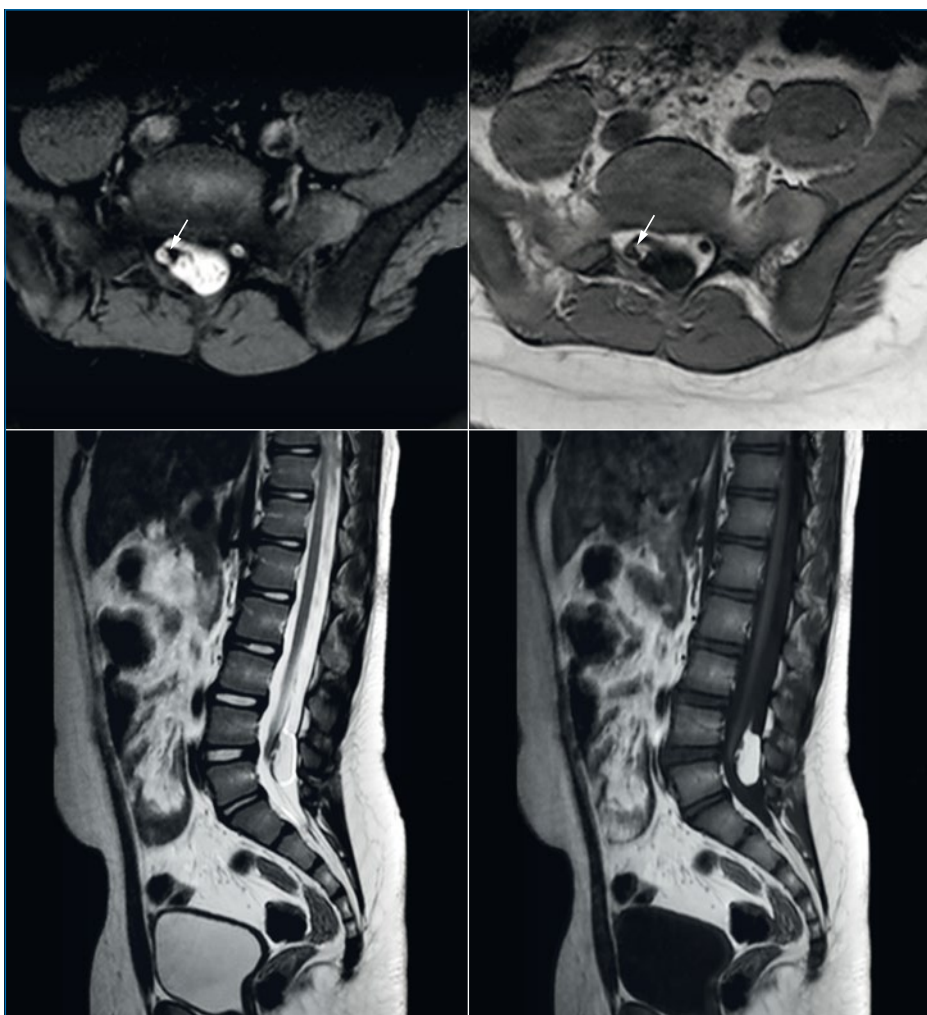


#### Neonate brain

A neonate underwent MRI on the first day of life on Achieva 1.5T and three days later on Ingenia 3.0T. For children under 2 years of age Dual IR sequences are used to obtain high-resolution T1 and T2 images in a single acquisition. These sequences allow a more accurate depiction of white matter maturation than conventional spin echo T1 imaging, especially at 3.0T, due to the lengthened T1.







#### Intrathecal lipoma in 11 y/o

11-year-old male with intrathecal lipoma involving descending nerve roots. In the spine, gradient sequences (modified e-THRIVE for T1 and T2 FFE) are used to overcome flow artifacts and decreased T1 contrast limitations common in axial 3.0T spine imaging. The addition of fat saturation pulses to the T2 FFE sequences has enabled better delineation of areas of intrathecal fat seen against the background CSF. Arrows point to fat extending along existing nerve roots on the right.

*“Ingenia’s biggest benefit for techs is the coil convenience.”*

“The ability to perform advanced imaging techniques such as perfusion, spectroscopy and diffusion tensor imaging allows additional characterization of disease processes that may be more difficult when just evaluated with conventional imaging,” he says.

“With the increased field strength and the increased SNR on Ingenia, our standard brain MRI now consists of very high resolution 1 mm 3D volumetric T1 imaging and no gap 2 mm axial T2 imaging. This higher resolution imaging has enabled us to better delineate small abnormalities and detect subtle changes such as abnormal gray/white matter differentiation in cases of potential cortical malformations in patients with epilepsy. The 3D T1 post-

contrast at 1 mm resolution reconstructed has enabled us to have a higher sensitivity for small contrast-enhancing abnormalities. And by using 3D acquisitions, we’re able to reconstruct additional planes of view and thus save scan time. With these volumetric data sets we also have good anatomic reference images as underlay for all of our DTI and fMRI studies. And we are increasingly utilizing these 3D data sets for fusion with metabolic imaging such as PET and SPECT.”

“We are beginning to also feed these high-resolution data sets into off-line post-processing programs to create segmented tissue classification images and quantitative determinations of parameters such as white and gray matter volumes and cortical thickness. These voxel-based morphology (VBM) techniques require high-resolution 1 mm isotropic volume data sets which we now acquire routinely. The goal of this additional image processing is to eventually provide clinicians with quantitative measurements of specific cerebral tissue components that could prove useful in diagnosing, characterizing and monitoring disease processes which conventional imaging fails to elucidate.”

#### Techs love dStream coils and SmartSelect

Ingenia’s dStream coils offer huge advantages for timesavings, patient comfort and workflow. Because the signal is digitized directly in the coil and sent through fiber optic cables, Ingenia can provide up to 40% more SNR than analog technology.

“Ingenia’s biggest benefit for techs is the coil convenience,” says Amber Pokorney, MR technologist at Phoenix Children’s. “The coils are so much more manageable than previous types of coils. They’re much easier to handle and have just one easy-to-use plug that plugs right into the table, so we don’t have to worry about the cables laying on the patient. And the added signal allows us to obtain a lot of detail.”

“We mostly use the Posterior coil, which is integrated into the tabletop. Not having to reposition patients is very helpful, especially if they’re anesthetized. It has improved our workflow because we can do multi-station exams – like covering brain, neck and spine – without having to interrupt the scanning to reposition the patient or position the coils.”

Another well-appreciated time saver is Ingenia's SmartSelect feature, which automatically selects the appropriate coil elements for each scan.

### Special imaging sequences

In addition to the fast workflow with the easy-to-use coils, Dr. Miller and his team have been optimizing sequences and ExamCards to provide the image quality and speed they need. "One of the challenges of pediatric compared to adult neuro imaging is trying to evaluate the maturational changes of white matter taking place in children less than 2 years of age. For these children we use Dual IR sequences to obtain high resolution T1 and T2 images in a single acquisition. These sequences allow a better depiction of white matter maturation than conventional spin echo T1 imaging, especially at 3.0T, due to the lengthened T1."

"While spine imaging at 3.0T can be challenging, standard sagittal spin echo spine sequences on our Ingenia are as good as or better than at 1.5T," Dr. Miller says. "We also use a modified e-THRIVE for T1 and T2 FFE to overcome flow artifacts and decreased T1 contrast limitations common in axial 3.0T spine imaging. The addition of fat saturation pulses to the T2 FFE sequences provides better delineation of areas of intrathecal fat seen against the background CSF."

"We find the angiographic imaging is very high resolution as well," he adds. "We get very good non-contrast neck imaging with Ingenia's 3D multi-chunk inflow MRA with very homogeneous WATS background fat suppression."

### Confident diagnostics and avoiding extra pre-surgical rescan

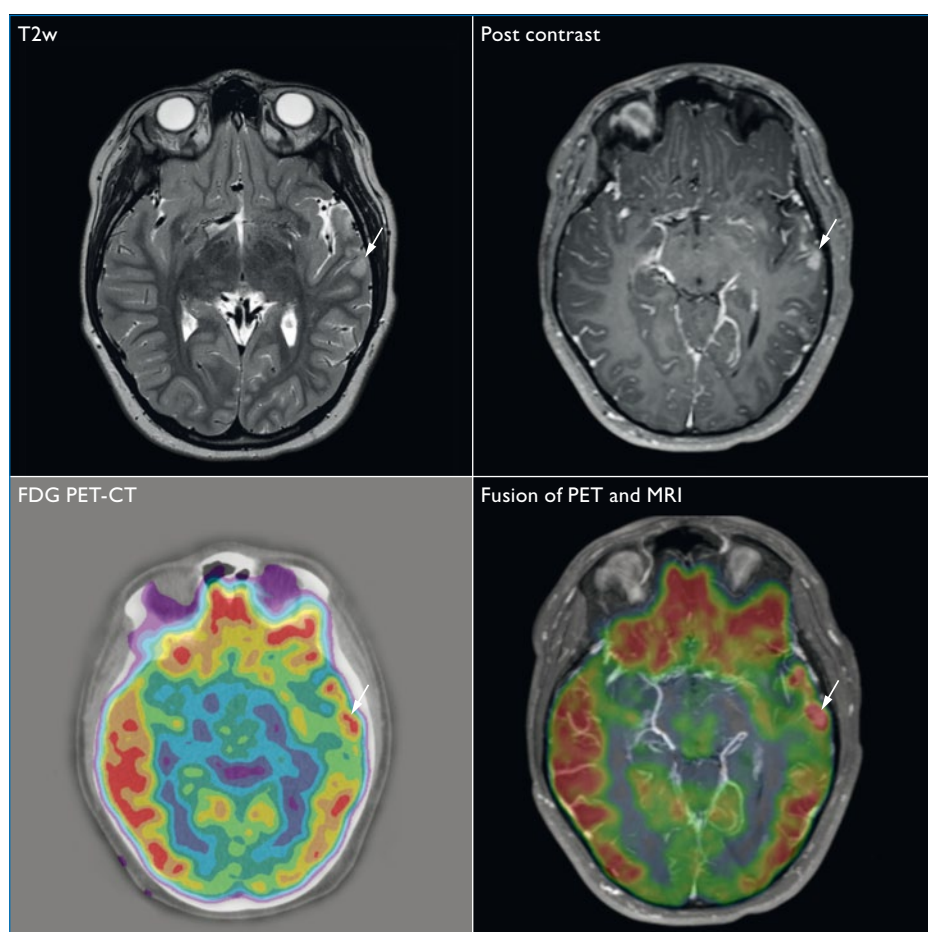
"Ingenia's advantages have had a big impact on the diagnostic side of imaging," says Dr. Miller. "Being able to produce such high-resolution imaging has allowed us to really have a great sensitivity for abnormalities, especially within the brain. It gives us a lot more confidence that we're not missing anything when the exams are normal."

"We have a very busy neurosurgical service, which relies heavily on imaging guidance for a lot of the neurosurgical procedures, for instance shunt catheter placement, tumor resection, and placement of electrocortical monitoring grids. Our standard brain T1 and T2 scans are of such a thin slice thickness that

they're easily imported into the neurosurgical image guidance system without having to rescan those patients at higher resolutions just for the procedure," Dr. Miller explains. "We see a reduction in our need to re-image patients to obtain high-resolution studies since we can use our standard scans for image guidance."

Overall, Dr. Miller is very pleased with the hospital's Ingenia system. "Philips' support has been excellent in helping us to navigate the optimization of the technology, and to translate that technology into beneficial imaging specialized for pediatrics according to our needs," he adds. ■

*"We use Dual IR sequences to obtain high resolution T1 and T2 images in a single acquisition."*



### Abnormal enhancing foci in 7 y/o

7-year-old male with seizures and small focal T2 hyperintense and contrast enhancing foci (white arrows).

The exact location of this abnormality is difficult to discern on FDG PET-CT. Fusion of the PET and contrast enhanced MRI allow precise localization of the lesion (arrow).