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# Shorter scan times and higher quality imaging reduce the need for sedation in pediatric patients

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As one of Sweden's largest pediatric hospitals, The Queen Silvia Children's Hospital routinely treats the most critically ill children from all over the country and occasionally from the Nordic region. The Radiology Department performs approximately 42,000 examinations each year across all imaging modalities. In MR imaging, we aim to reduce the number of children who require sedation to complete the examination. Over the last several years, we've invited children for

a study visit together with play therapy prior to their scheduled examination. We have also implemented free-breathing protocols for our cardiac and abdominal MR examinations, which have reduced the need for anesthesia and sedation.

Shorter examination times also help avoid sedation in older children and reduce the duration of sedation in cases where it is required, such as in newborns. With AIR™ Recon DL we can obtain the resolution

that we need for these young patients at a reasonable scan time. We also routinely employ Acoustic Reduction Technique (ART) for a quieter examination that is not as frightening for younger children.

New in the latest software from GE HealthCare is MENSA Nerve, which provides high-resolution T2-weighted MR neurography and vascular suppression. We have found this to be a valuable technology for trauma cases as well as neurofibromas (Case 2).

SIGNA™ Architect 3.0T					
Venous ischemia	Sagittal T2 CUBE	Sagittal MP-RAGE	T2 PROPELLER	SWAN	DWI
TR (ms):	3000	2939	5695	47.4	10408
TE (ms):	130	4.4	121	22.8	74.8
FOV (cm):	22	20	20	20	20
Slice thickness (mm):	0.8	0.8	2.5	2	2.5
Frequency:	292	264	464	320	144
Phase:	292	264	464	288	192
NEX:	1	1	1.5	0.86	2
Scan time (min.):	2:58	5:00	3:26	3:02	1:44
Options/other:	ART, AIR Recon DL	ART, AIR Recon DL	ART High, AIR Recon DL	HyperSense, ARC	b0, b1000, AIR Recon DL, Distortion Correction

## Case 1

### Patient history

A full-term, 5-day-old female was hospitalized for hypoglycemia and focal left-sided seizures. There was some impact on umbilical cord samples, however, the infant was not initially assessed as asphyxia. Upon further investigation, thrombosis was discovered in the aortic descendence. The patient has an umbilical catheter, which is a risk factor for thrombosis. Patient underwent MR to determine if there were ischemic changes, bleeding or asphyxia.

### Results

Patient had thrombosed medullary veins, which contributed to venous ischemia with bleeding elements. The patient showed no typical clinical or radiological signs for asphyxia. However, the findings demonstrated a very unusual image with widespread signal changes, prompting further investigation into the underlying cause of thrombosis.

### Discussion

That newborns and small children can undergo MR examinations without the need for sedation is very valuable to us and to our patients. Using techniques for acoustic reduction is therefore important and something that we use for many of our patients. Most of the sequences in this exam utilized ART and nearly all sequences were acquired with AIR Recon DL to enhance SNR and reduce scan time, except for 3D SWAN where HyperSense was employed. Distortion correction was applied in the DWI acquisition.

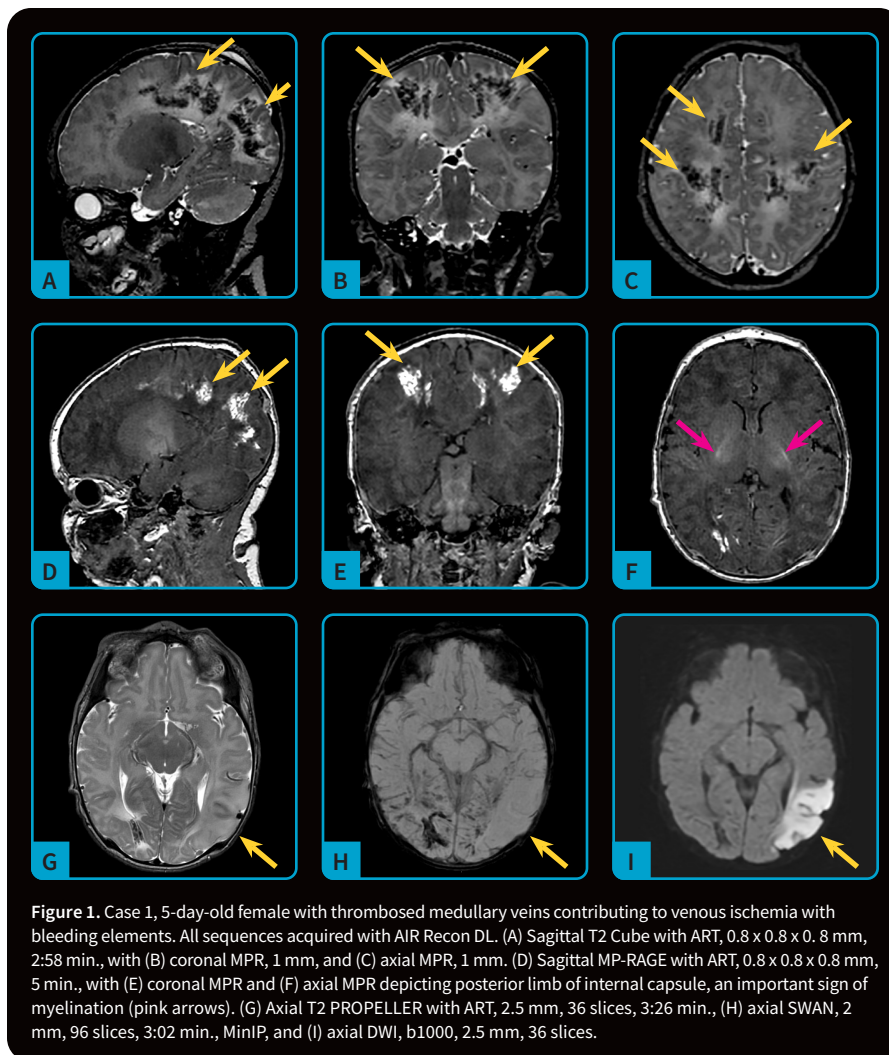
The combination of these technologies, coupled with the high spatial resolution and outstanding image quality enabled by AIR Recon DL, especially in our 3D sequences, really makes a difference when we examine very young patients.

SIGNA Architect 3.0T	
Neurofibromas	Coronal MENSA Nerve
TR (ms):	12.2
TE (ms):	4.6
FOV (cm):	36
Slice thickness (mm):	1
Frequency:	360
Phase:	360
NEX:	1
Scan time (min.):	5:09
Options/other:	AIR Recon DL; NPW1.5

### Case 2

#### Patient history

An 11-year-old male with neurofibromatosis type 1 and autism. Prior MR depicted multiple plexiform neurofibromas paravertebral right. After consultation with



**Figure 1.** Case 1, 5-day-old female with thrombosed medullary veins contributing to venous ischemia with bleeding elements. All sequences acquired with AIR Recon DL. (A) Sagittal T2 Cube with ART, 0.8 x 0.8 x 0.8 mm, 2:58 min., with (B) coronal MPR, 1 mm, and (C) axial MPR, 1 mm. (D) Sagittal MP-RAGE with ART, 0.8 x 0.8 x 0.8 mm, 5 min., with (E) coronal MPR and (F) axial MPR depicting posterior limb of internal capsule, an important sign of myelination (pink arrows). (G) Axial T2 PROPELLER with ART, 2.5 mm, 36 slices, 3:26 min., (H) axial SWAN, 2 mm, 96 slices, 3:02 min., MinIP, and (I) axial DWI, b1000, 2.5 mm, 36 slices.

the treatment conference, the neurology clinic recommended a new MR examination.

### Results

Slight size progression of previously known multiple plexiform neurofibromas located elongated paravertebral right.

### Discussion

We typically utilize Cube STIR when imaging the neck in these cases. However, with the new MENSA Nerve we wanted to compare it to the conventional sequence. MENSA Nerve is a two-echo steady-state acquisition. In this case, the first echo acquired was a free induction delay (FID) signal for T1- and T2-weighted imaging; the second echo acquired was a time-reversed FIESTA echo (T2-weighted) with vascular suppression. These two acquisitions helped depict the neurofibromas from the lymph node.

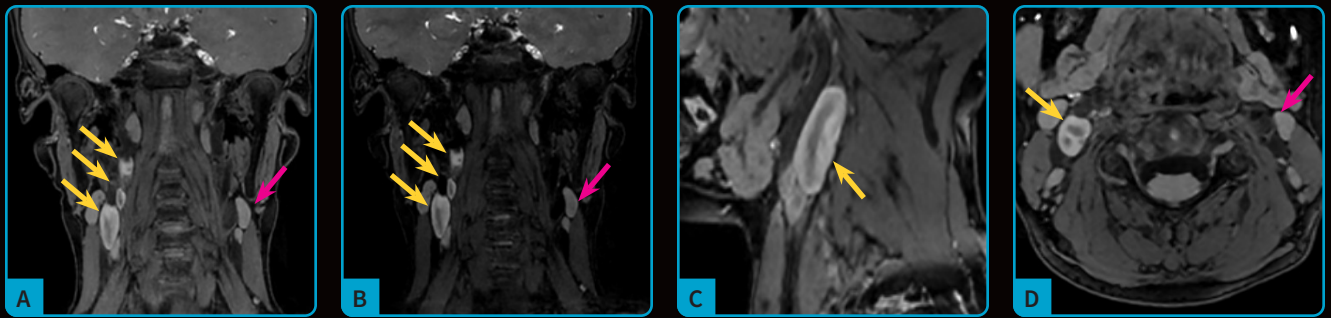
### Case 3

#### Patient history

A 9-year-old male with focal seizures. A prior brain MR showed suspected focal cortical dysplasia parieto-occipital on the left side. Epileptic surgery was planned and an MR was obtained to help confirm the diagnosis of focal cortical dysplasia and localize the visual pathways and visual cortex for surgical planning.

### Results

As previously known, there is a cortical malformation occipitally on the left side in the form of thickened cortex around some sulci with a blurred border between gray and white matter. Subcortical white matter changes that partly have streaks towards the posterior horn of the left lateral ventricle were also noted.

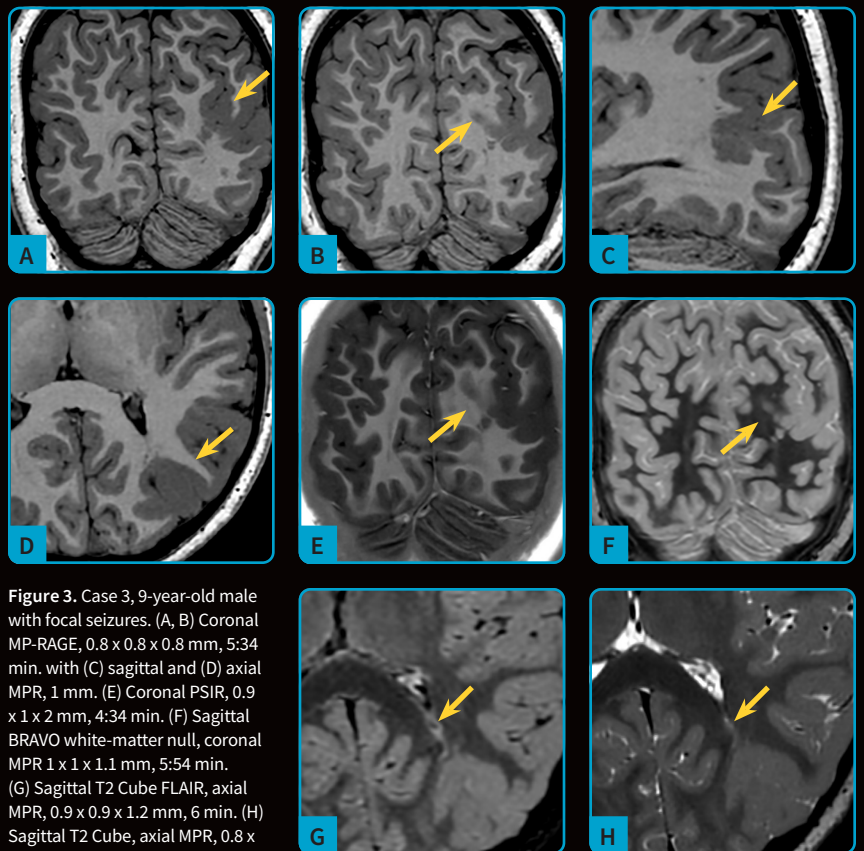


**Figure 2.** Case 2, 11-year-old male with neurofibromatosis type 1 and autism. MENS A Nerve provides high-resolution T2-weighted MR neurography with vascular suppression and is compatible with AIR Recon DL. Coronal MENS A Nerve, 1x1x1 mm, 5:09 min., (A) FID-echo for T1- and T2-weighted imaging; (B) time-reversed FIESTA echo (T2 weighted) with vascular suppression; (C) sagittal MPR, 1 mm, (D) axial MPR, 1 mm; neurofibroma (yellow arrows) and lymph node (pink arrows).

SIGNA Architect 3.0T					
Cortical Dysplasia	Coronal MP-RAGE	Sagittal BRAVO WM Null	Sagittal T2 CUBE	Sagittal T2 CUBE FLAIR	Coronal PSIR
TR (ms):	3477	8	2750	6500	1850
TE (ms):	2.9	3.2	101	135	22.9
FOV (cm):	24	24	24	25	26
Slice thickness (mm):	0.8	1.1	0.8	1.2	2
Frequency:	288	264	300	288	288
Phase:	288	264	300	264	264
NEX:	1	0.79	1	1	1
Scan time (min.):	5:34	5:54	5:17	6:01	4:34
Options/other:	HyperSense, AIR Recon DL	HyperSense, AIR Recon DL	AIR Recon DL	AIR Recon DL	AIR Recon DL

## Discussion

Cortical dysplasia can be very subtle. In epileptic patients, it is important to acquire images with very high spatial resolution to detect these small changes. To minimize patient movement, these patients are examined under anesthesia. With the implementation of AIR Recon DL on 2D and 3D, we have been able to shorten the total examination times for these patients. Previously, the 3D volume acquisitions had scan times of 7-8 minutes due to not using any acceleration methods to obtain the highest possible image quality. Now with AIR Recon DL, we can add acceleration for shorter exam times of 5-6 minutes for 3D acquisitions and benefit from the increase in image quality that this technology provides. S



**Figure 3.** Case 3, 9-year-old male with focal seizures. (A, B) Coronal MP-RAGE, 0.8 x 0.8 x 0.8 mm, 5:34 min. with (C) sagittal and (D) axial MPR, 1 mm. (E) Coronal PSIR, 0.9 x 1 x 2 mm, 4:34 min. (F) Sagittal BRAVO white-matter null, coronal MPR 1 x 1 x 1.1 mm, 5:54 min. (G) Sagittal T2 Cube FLAIR, axial MPR, 0.9 x 0.9 x 1.2 mm, 6 min. (H) Sagittal T2 Cube, axial MPR, 0.8 x 0.8 x 0.8 mm, 5:17 min.