Pediatric SENSE Head/Spine coil simplifies infant studies

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When applying “adult” coils for infants, the large coil elements and their distance from the patient can yield suboptimal SNR. In head/spine examinations in infants, another problem has been the risk of waking sleeping patients when swapping head and spine coils. At Astrid Lindgren Children’s Hospital, radiographers led by Bo Ehnmark, have evaluated Philips’ Pediatric SENSE Head/Spine coil for 12 patients. The coil’s small elements, integrated design and light weight have provided an excellent solution.

Astrid Lindgren Children’s Hospital, part of Karolinska University Hospital (Stockholm, Sweden), developed an innovative way to scan their youngest patients, children ranging in age from hours-old to 12 weeks old. The “Feed-and-Sleep” protocol entails bringing infant patients in 30 minutes before their examination, feeding them and then allowing the babies to fall asleep. Because the children are brought in overdue for a nap anyway, it is more likely that the patients will sleep motionlessly (with ear protection) for at least the 30 minutes it takes to scan them.

For Achieva 1.5T brain studies in this patient group, the Children’s Hospital has commonly used the 8-channel SENSE Head coil or the SENSE Spine coil.

“For brain-only studies we have used the SENSE Head coil,” Ehnmark says. “It’s a good coil with ample space on the inside for headsets, but its size also is a disadvantage. It’s too big for infants, so we don’t obtain optimal SNR because the coil elements are too far away from the head.”

In addition, if clinicians wanted to investigate the spine as well, technologists risked waking the sleeping baby when swapping the head coil for the SENSE Spine coil, and SNR was not optimal. “Swapping coils is too clumsy,” Ehnmark observes. “And the SNR in the spine has not been sufficient in two- to three-kilogram babies.”

Sequential infant head/spine studies became easier when Astrid Lindgren’s Children’s Hospital acquired the 16-channel SENSE NeuroVascular coil about a year ago. When integrated with the SENSE Spine coil, clinicians could look at the brain, possible
problems in the upper cervical spine (e.g. Chiari malformation) and lower cervical spine (e.g. tethered cord), all the way to the lumbar spine and pelvis, without changing coils. Still, signal issues persist when using the adult-designed spine coil for infants.

“Babies-only” Pediatric SENSE Head/Spine coil performs well in test
Astrid Lindgren Children’s Hospital evaluated the Pediatric SENSE Head/Spine coil on Philips’ Try & Buy program, using the coil in 12 examinations over an eight-week period. The typical weight range of the patients was 4.5 to 6.5 lbs. (2-3 kilograms). Ehmark believes one of their patients, a 17.6 lb. (8 kilograms) 10-month-old represents the maximum feasible size for the coil. The Children’s Hospital’s first case for the pediatric SENSE Head/Spine coil was at the opposite end of the spectrum, a 6-hour old infant (see images).

“We received the coil around lunchtime and by one o’clock it was on the table ready to scan this 6-hour old baby with suspected hydrocephalus.”

For the Feed-and-Sleep patients who require an examination of head and spine, the pediatric SENSE Head/Spine coil seems tailor-made, he adds. “With Feed-and-Sleep, we have a 30-minute window to perform the examination. It’s usually not more, because of the increasing chance that the baby will wake up from his nap and start to cry and move. Then it’s all over,” Ehmark explains. “With our traditional solution, the lower SNR required more signal averages, which could increase the scan time past 30 minutes. Sometimes we got lucky and the baby stayed asleep, but most times we had to end the study because the infant woke up.”

Clear visualization of congenital anomalies
Ehmark has found that the Pediatric SENSE Head/Spine coil has provided excellent visualization of a tethered spinal cord, a neurological disorder caused by tissue attachments that limit spinal cord movement. The resultant stretching of the spinal cord as the baby grows interferes with nerve function. “In infant spine imaging, you need high resolution, which has been very tricky with a standard spine coil,” he says.
“But with the dedicated pediatric coil, we can see this clearly in babies.” Among the 12 patients that Astrid Lindgren’s Children’s Hospital scanned using the pediatric coil, several had brain tumors, which Ehnmark reports were visualized at least as well as they had been with the NeuroVascular coil. The design of the Pediatric SENSE Head/Spine coil, however, enabled better accommodation of the tubing and wires of ancillary monitoring equipment.

From the start, he was surprised that technologists could use the department’s existing ExamCards with the pediatric coil. “We obtained very good results,” he says. “In the long run, with more experience with this coil, I think we could still optimize the protocols and get even better images, but I was amazed that we acquired such good images with the standard sequences.”

A special feature of Achieva systems that contributes to these results is the ability to adjust the FOV while maintaining the same voxel size.

“That means we can use the same ExamCard whether the baby is two kilograms or five kilograms,” Ehnmark observes. “With an older system or with other vendor’s machines, when changing the FOV, you also have to manually adapt the voxel size, increasing it for larger patients and decreasing if for smaller patients. We don’t need to do that – our Achieva is a very pediatric-friendly system.”

Astrid Lindgren Children’s Hospital neuroradiologist, Chen Wang, MD, PhD, also reports favorable first impressions of the pediatric

Treated metastatic lesion in 14-month-old

Follow-up MRI exam of a 14-month-old male patient who was treated for a metastatic lesion in the brain. This was the first use of the pediatric SENSE Head/Spine coil with the patient under general anesthesia. Note that there is ample space in the coil for anesthesia equipment. The high quality images clearly show the lesion and surrounding brain anatomy.
Intraspinal extension, tethered cord in 2-week-old

A two-week-old infant was referred for MRI investigation of a skin lesion in the midline of the lower back. Such a lesion can be suspicious of a meningomyelocele. Often covered by skin, a meningomyelocele can result in a tethered cord, a neurological disorder caused by tissue attachments that limit spinal cord movement. The resultant stretching of the spinal cord as the baby grows interferes with nerve function. In children, symptoms may include lesions and hairy patches, in addition to leg weakness, lower back pain, incontinence and loss of bowel control. If the disorder is not addressed, symptoms will progress. The patient was examined using the Feed-and-Sleep protocol, which requires a rapid study not exceeding 30 minutes (to ensure a reasonable likelihood that the patient will remain asleep). The images confirmed the question of dermal sinus with intraspinal extension and tethered cord.

SENSE Head/Spine coil. “Our preliminary test results are very promising, with high quality images that to our eyes are superior, or at least equal to, the images obtained with a standard coil,” he says. “Controlled comparative studies may be needed before we make firm conclusions, but we definitely are looking forward to further evaluations of this RF coil.”

Lightweight coil makes technologists lives easier

The size and weight of the pediatric SENSE Head/Spine coil makes it very easy to use, according to Ehnmark. “The pediatric coil seems to weigh almost nothing,” he says. “Some of the other coils are noticeably heavier.”

The Pediatric SENSE Head/Spine coil comes with a special mattress that enables precise positioning of the coil centered on the patient table. The mattress’s thickness brings it flush to the part of the coil on which the patient lays, allowing technologists to wrap the baby in a blanket outside the coil and gently pull him into position inside the coil.

Coil fulfills a real need

Scanning these infant patients is a growing application at the medical center, Ehnmark reports. “We’re seeing a big increase in demand for studies of these congenital problems, for which the pediatricians can appreciate the importance of MRI,” he says. “And, unfortunately, we also are seeing more emergency cases. We will put the Pediatric SENSE Head/Spine coil to good use.”

Chen Wang, MD, PhD

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