Somatom Definition Flash from Siemens for pediatrics: computed tomography without sedation and breath hold, and with very low dose

At the Congress of the International Society of Pediatric Radiology (IPR) in London from May 28 to 31, 2011, Siemens Healthcare will for the first time show how pediatrics can benefit from the technological advances in computed tomography (CT). For instance, Siemens will introduce its new CT applications for dose reduction. Additionally, scientific studies will be presented to show why Somatom Definition Flash is particularly suited for pediatrics. The Dual Source computed tomography system, with two X-ray tubes and detectors, respectively, remains the world’s fastest scanner and minimizes radiation dose for the patient. In various studies, physicians have used this system to scan infants in below one second, and with an X-ray dose of less than one mSv (millisievert). The resulting images show a high quality without motion artifacts. Using conventional CT technology with only one tube-detector system, this procedure would take several seconds and require a significantly higher dose. In addition, children would have to hold their breath and babies would have to be sedated to prevent motion artifacts that could distort the diagnosis.

Computed tomography is the method of choice for many indications that require displaying the heart or chest cavity. In the past, however, this imaging method was rarely used in pediatrics because children should be subjected to as little radiation as possible. In addition, infants generally have to be sedated for a CT examination to prevent disturbing motion artifacts during the scan. Sedation implicates certain risks and, in some cases, may cause severe side effects. In addition, the procedure requires anesthesia service and aftercare, which is time-consuming and staff-intensive. In the USA, for example, the costs for anesthesia service can run as high as 1200 US-Dollars per hour. Because of the risks and possible side effects, babies are often only mildly
sedated. As a result, around 15 percent of children wake up during the scan and move. As a consequence they have to be re-sedated and in some cases the scan has to be repeated.

When Siemens launched the Somatom Definition Flash CT scanner in 2009, many CT users immediately recognized its potential for pediatric radiology: the new generation of Dual Source computed tomography systems reduces the required dose by up to a factor of 20. The high scanning speed in the Flash Scan mode enables all patients to be examined without breath holds, and even requires no sedation for the youngest patients. Using various studies, Siemens will show at IPR 2011 how the Dual Source technology of the Somatom Definition Flash can advance pediatric diagnostics. In addition, two radiologists and a pediatric cardiologist will present their latest findings obtained during pediatric examinations with the Somatom Definition Flash.

Studies in pediatric radiology
A study at the University of Erlangen\(^1\) has shown that children between the ages of 14 and 17 months can undergo thoracic examinations without sedation, with an average scan time of 0.49 seconds and 1.9 mSv effective dose, producing images of diagnostic quality in all cases.

Researchers at the Hospital of Kunming Medical College in China were able to examine children with congenital heart defects without breath holds. The scan time was 0.5 seconds with an effective dose of 0.29 mSv\(^2\). Physicians at the Centre Chirurgical Marie Lannelongue in France, who also examined children with congenital heart defects, even only required a dose of 0.26 mSv\(^3\).

Dose-reducing CT applications from Siemens
The tube voltage to be selected in CT, which is known as the kV (kilovolt) level, depends on the size and weight distribution of the patient, as well as on the examination type. Selecting the respective suitable kV level means that image quality can be optimized and dose minimized significantly. If the tube voltage is changed, all other scan parameters have to be adapted accordingly. However, since the dependencies are not linear and their adjustment is intricate, today the values have to be calculated manually using complex formulas, or estimated. Studies have shown that users generally tend not to change the kV values for this reason, and therefore do not exploit the full dose-saving potential. Here, Siemens is offering a solution for the first time:

\(^2\) Han K et al. Accuracy and Safety of High Pitch Computed Tomography Imaging in Young Children with Complex Congenital Heart Disease.
depending on the patient’s anatomy and the type of examination, Care kV automatically recommends the correct tube voltage for the selected tube current in milliampere (mA). All other parameters are adapted automatically to the selected kV level. This optimizes the relationship between contrast and noise in the image. Additionally, dose can be reduced by up to 60 percent. The application is currently being tested by a number of pediatric radiologists.

While the voltage values commonly used today range between 80 and 140 kV, the Care Child function enables to perform CT examinations at only 70 kV, resulting in significant dose savings particularly for children and babies. This power level is possible because Siemens further enhanced its Straton tube in a way to generate these low voltages. This represents yet another technical innovation from Siemens that will reduce the X-ray dose even further.

Safire (Sinogram Affirmed Iterative Reconstruction), a new method for iterative reconstruction of CT images based on CT raw data, is yet another dose saving measure. At the end of 2009, Siemens presented IRIS (Iterative Reconstruction in Image Space), its first innovation for iterative reconstruction. With Safire, Siemens has further enhanced the algorithms and is also offering new hardware that enables to significantly reduce the time required to reconstruct slice images in comparison to IRIS.

At IPR 2011, radiologists and pediatric radiologists will explain how – compared to non-iterative reconstruction procedures – it is possible to reduce the radiation dose for children by up to 60 percent using Safire.

Background on Somatom Definition Flash
The Somatom Definition Flash is a Dual Source CT system where two X-ray tubes rotate around the body simultaneously. The highest scan speed in CT to date (45 centimeters per second) and a temporal resolution of 75 milliseconds enable complete thoracic scans in just 0.6 seconds. As a result, patients no longer have to hold their breath, as it was necessary in the past. At the same time, Somatom Definition Flash works with a much lower radiation dose. For example, a routine cardiac scan on a patient of up to 90 kilograms can be performed with less than one millisievert (mSv), while the average effective dose is generally between 8 and 20 mSv.

Press photos are available at:
http://siemens.com/healthcare-pictures/flash-pediatrics
The products mentioned here are not commercially available in all countries. Due to regulatory reasons the future availability in any country cannot be guaranteed. Further details are available from the local Siemens organizations.

The Siemens Healthcare Sector is one of the world’s largest healthcare solution providers and a leading manufacturer and service provider in the fields of medical imaging, laboratory diagnostics, hospital information technology and hearing instruments. It offers solutions covering the entire supply chain under one roof - from prevention and early detection to diagnosis and on to treatment and aftercare. By optimizing clinical workflows oriented toward the most important clinical pictures, Siemens also strives to make healthcare faster, better and, at the same time, less expensive. Siemens Healthcare currently has some 48,000 employees worldwide and is present throughout the world. During fiscal 2010 (up to September 30) the Sector posted sales worth 12.4 billion euros and profits of around 750 million euros. For further information see: www.siemens.com/healthcare.