Improved patient experience and more precision medicine from strengthened CT portfolio

Siemens Healthineers have introduced an impressively expanded portfolio of CT scanners. These include high-end systems for single- and dual-source imaging — Somatom Edge Plus, Somatom Drive, and Somatom Force — which introduce to the CT market the innovative FAST (fully assisting scanner technologies) Integrated Workflow with the brand new FAST 3D Camera. Using artificial intelligence and deep learning technology, the camera automatically facilitates precise and consistent isocentric positioning of patients. By reducing unwarranted variations and avoiding scan repeats, diagnostic imaging is more precise and involves lower costs

In the high-end segment, Siemens Healthineers has enhanced its portfolio: Somatom Edge Plus is the new premium single-source system, and Somatom Force is the new version of the leading system in the dual-source field – i.e., systems equipped with two X-ray tubes and two detectors. The new systems allow clinical users to cover all computed tomography applications, regardless of the patient or the clinical issue at hand. Both systems also offer high-precision diagnostics, which is a prerequisite for individualized prevention and therapy. "*More than 200 scientific papers exist that show what Somatom Force is capable of,*" says André Hartung. "*With this new version of our top-of-the-range system, we want to help our customers take the next step on their way to precision medicine.*"

A 3D camera fitted above the patient table uses artificial intelligence and deep learning technologies to recognize the patient's anatomical landmarks. The table then automatically moves into the correct position and adopts the correct height to position the desired body region at isocenter and achieve an optimal examination result. With the brand new single-source Somatom Edge Plus system sharp and rich-in-contrast images can be obtained at high speed and low dose even with large patients. Copyright: Siemens Healthcare GmbH

" .. Incorrect positioning is an obstacle to achieving optimal results ..."

AUTOMATIC PATIENT POSITIONING.

The improved diagnostics result from FAST (fully assisting scanner technologies) applications that are integrated into the premium systems.

One of these applications is the innovative FAST Integrated Workflow with the all new FAST 3D Camera for automatic patient positioning. In many CT examinations, incorrect patient positioning is an obstacle to achieving optimal results. Studies have shown that this is the case in 95 percent of scans with an average positioning misalignment of 2.6 centimeters [1, 2]. This results in more image noise or – to counteract the noise – in increased dose levels.

In the study of Li *et al.* [1] it was found, that in their practice, most patients were not appropriately centered in the gantry despite instructions to the contrary. The wide range of off-centering, namely 2.6–60 mm in their study, regardless of body region, sex, or patient size may have been caused by lack of proper training, lack of attention to the finer aspects of CT, lack of time in a busy clinical schedule, lack of defined anatomic centering landmarks, patient-related factors, or reliance on two localizer

" .. Li et al... found a substantial reduction (as much as 30%) in surface radiation dose with appropriate patient centering ... emphasizing that optimum patient centering is critical for maintaining image quality and reducing radiation dose [1]..."

radiographs with the possibility of shifting of the reconstructed field of view in either direction. Although *Li et al.* [1] did not assess causes of off-centering of patients, they found a substantial reduction (as much as 30%) in surface radiation dose with appropriate patient centering with the automatic technique, emphasizing that optimum patient centering is critical for maintaining image quality and reducing radiation dose [1]

In another study, Kaasalainen *et al* [2] point out that CT optimization has a special importance in children, since smaller body size accentuates the importance of patient positioning affecting both radiation dose and image quality. Using anthropomorphic phantoms Kaasalainen *et al* studied the effect of vertical positioning on organ

" .. Significant changes in organ doses resulting from vertical positioning were observed, especially in radiosensitive anterior organs [2]..."

dose, image noise and contrast in pediatric chest CT. Significant changes in organ doses resulting from vertical positioning were observed, especially in radiosensitive anterior organs [2]. The breast dose increased up to 16% and the thyroid dose up to 24% in lower positions. The noise was increased up to 45% relative to the centre position in the highest and lowest vertical positions, with a particular increase observed on the anterior and posterior sides, respectively.

The automatic patient positioning workflow in Somatom Edge Plus and the dual-source scanners Somatom Drive and Somatom Force allows users to avoid such misalignments significantly. A 3D camera fitted above the patient table uses artificial intelligence and deep learning technologies to recognize the patient's anatomical landmarks. The table then automatically moves into the correct position and adopts the correct height to position the desired body region at isocenter and achieve an optimal examination result. This means institutions can avoid repeat scans, decrease the time required for both patients and staff, and therefore benefit from precise diagnostics at lower cost. In addition, the two touch-operated control panels fitted directly on the scanner allow radiology staff to stay close to the patient during the majority of the time needed for scan preparation.

TIN FILTER TECHNOLOGY

The brand new single-source Somatom Edge Plus system combines the Straton MX Sigma Xray tube, high power reserves at every kV value in 10-kV steps, and the Stellar Infinity detector. This provides the powerful imaging chain for scanning obese patients with diagnostic confidence – enabling sharp and rich-in-contrast images at high speed and low dose. In addition, the scanner is equipped with TwinBeam Dual Energy scan modes and the Tin Filter technology that facilitates CT scans at very low doses by shielding patients from clinically irrelevant radiation. Tin Filter technology can be used in all routine examinations and allows users to perform CT imaging at very low dose values which, in the case of lung cancer screening for instance, do not exceed those of a normal X-ray examination. With the introduction of the new scanners, Tin Filter technology is now available across the complete Siemens Healthineers CT portfolio.

FUNCTIONAL IMAGING

As already proven in its first version, the new version of the top-of-the-range Somatom Force system generates impressive results, especially when it comes to highly challenging situations. One example here is functional imaging. Although functional imaging provides additional image information, the high levels of radiation involved mean that it has yet to become routine in many applications. Somatom Force allows functional imaging to become part of clinical practice because it offers a perfusion range of up to 22 centimeters that can cover entire organs. Its Vectron X-ray tubes with a power-independent focal spot size of just 0.4 × 0.5 (IEC) and the highly sensitive Stellar Infinity detector make the Somatom Force the ideal scanner when high-speed (up to 737 mm/s), large-volume coverage combined with outstanding image quality is a must. Furthermore, the scanner offers precise and dose-neutral quantification with the best spectral separation in Dual Energy acquisition to generate high-quality diagnostic results.

IMAGE POSTPROCESSING

Somatom Force also sets new standards when it comes to image postprocessing. Rapid Results Technology allows the dual-source scanner to communicate directly with Syngo.via for zero-click postprocessing. As a result, large Dual Energy CT datasets are sent automatically to the picture archiving system (PACS). This task is now part of standard reconstruction enabling standardized and consistent image quality, independent of operator skills.

REFERENCES

1. Li J, Udayasankar UK, Toth TL *et al*. Automatic patient centering for MDCT: effect on radiation dose. AJR 2007; 188: 547 – 552.

2. Kaasalainen T, Palmu K, Lampinen A *et al*. Effect of vertical positioning on organ dose, image noise and contrast in pediatric chest CT-phantom study. Pediatric Radiology 2013; 43: 673 – 684.