CT SCANS OFFER FRESH INSIGHT

Computed tomography has a NEW UPRIGHT DESIGN, HIGHER-RESOLUTION IMAGES AND INNOVATIVE WORKFLOW SOFTWARE — all expanding the usefulness and accessibility of this powerful diagnostic tool.

When a new type of high-resolution computed tomography (CT) device was unveiled in Japan in 2017, it revolutionized the field, offering more than twice the resolution of conventional CT devices.

This market debut was quickly followed by the release of a new deep-learning software for reconstructing CT images, called AiCE. It helped calculate the lowest dose needed to make high-resolution scanning possible, while also significantly reducing the noise in the images.

The medical imaging company behind these advances, Canon Medical Systems, is now using new image-improving AI, major hardware innovation and fresh workflow software to visualize previously unseen details from CT scans and to drive efficiencies.

HIGH-RESOLUTION SCANS

Masahiro Yanagawa, a radiologist at Osaka University, believes that noise-free, high-resolution CT scans will be a game-changer in diagnosing lung diseases. "The lungs are an intricate organ with more than 23 airways branching from the trachea to the alveoli," he says.

"High-resolution scans have made it possible to clearly visualize the smaller peripheral branches, 0.4–0.5 millimetres in diameter, that traditional CTs can't capture."

This level of acuity (see image below) aids in predicting how aggressive lung cancers are likely to be[1]. Specifically, it can help with detection of obstructed bronchi, as well as solid tumours larger than eight millimetres across, which are indicative of aggressive lung cancers.

High-resolution images are also useful for informing surgery, says Yanagawa. Typically, surgeons remove a little extra tissue around a tumour to prevent the spread of cancer cells from neighbouring areas. With high-resolution scans that detail the tumour boundary and microenvironment with more precision, they might be able to better determine where this margin should be.

Yet more promising is a deep-learning AI-based image-reconstruction software. This software can take normal-resolution images acquired from conventional high-end CT scanners and enhance them to a similar quality to high-resolution images, says Ram Narayanan Sastry, a senior marketing manager at Canon Medical Systems in Tochigi, Japan.

The technology was designed using assisted learning, with the close monitoring of AI scientists, instead of self-learning by the algorithm itself.

Called Precise IQ Engine (PIQE), the technology offers sharper anatomical detail and minimizes common glitches such as the overestimation of the size and density of tissue caused by the presence of materials such as calcium. This is promising for examining areas with calcium accumulation, which often include arteries or areas with stents, which can

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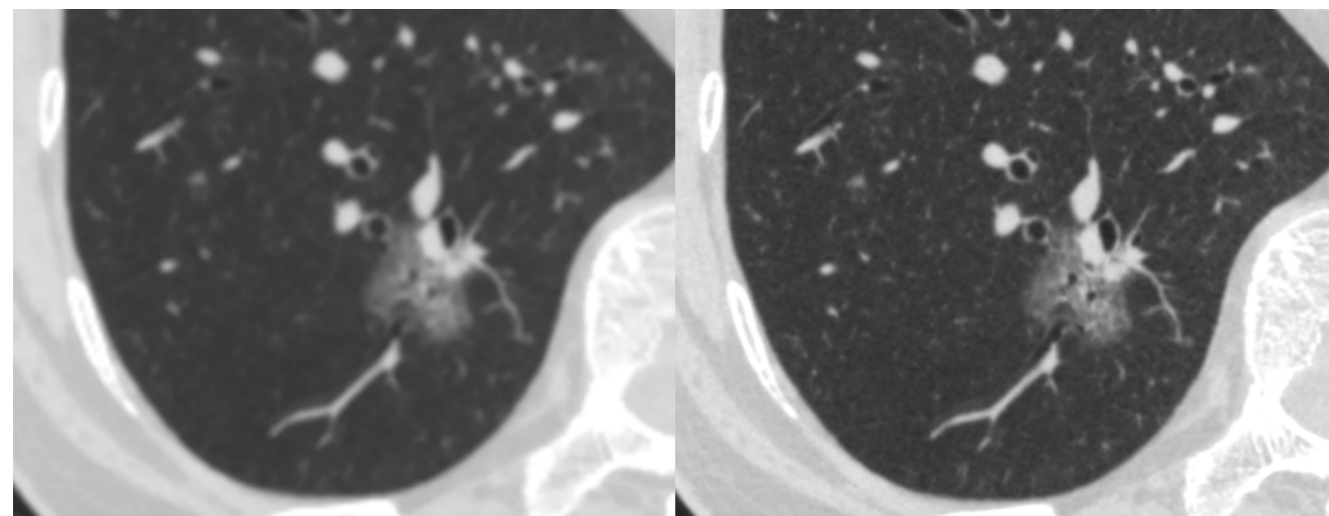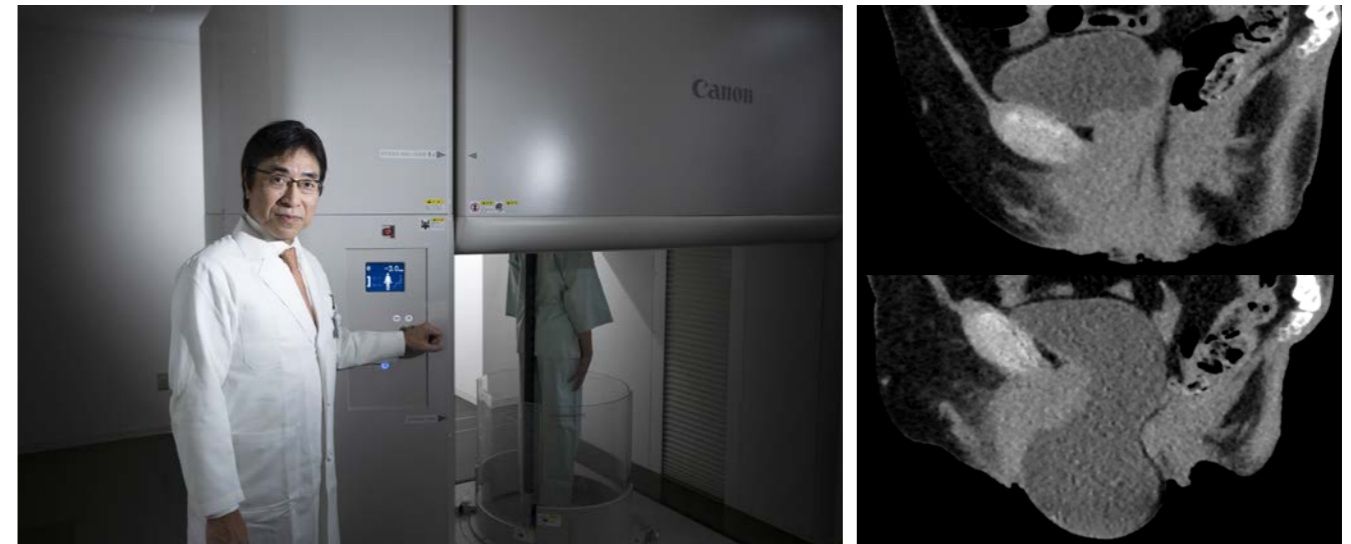
The scans are also showing promise for examining the severity of COVID-19 infections. They can reveal the distribution and characteristics of COVID-derived pneumonia and loss of lung volume with precision[2]. Additionally, they can help diagnose pulmonary fibrosis, as the scans make even the smallest of calcifications — an indicator of the disease — easily visible[3].

▲ Masahiro Jinzaki from Keio University with the upright computed tomography (CT) system. A prolapsed bladder evident in a CT scan using an upright CT (right, at bottom) is not visible at all in a conventional supine CT (right, at top).

also blur tissue boundaries in CT scans. Originally limited to scans of the heart, in November 2023 PIQE became available for body imaging as well.

UPRIGHT CT

Along with scanning resolution improvements, recently, a new form of CT known as 'upright CT' has appeared[4]. It can detect medical conditions that appear or become worse when patients stand upright. And importantly, upright CTs also provide a better workflow, as patients can walk in and out through examination rooms in a way similar to X-ray exams.

"The idea of upright CTs has been around for half a century, but the scanning time was too long to keep patients still while standing. As a result, the idea never came to fruition," explains Masahiro Jinzaki, a professor from Keio University in Tokyo, who, in 2017, developed the new clinical upright CT scanner in collaboration with Canon Medical Systems.

Advancements in multi-detector computed tomography scanning speeds made upright CT scans a possibility, he says. The device has proven effective in diagnosing conditions such as pinched nerves in the lumbar that worsen when standing and walking, a prolapsed bladder (pictured above right), in which the bladder drops from the pelvis, or hernias in which the small intestine and fat tissue protrude into the groin while standing.

Upright CTs have also revealed new insights about human anatomy. Jinzaki has found that the volume of venous system — which transports blood from the periphery back to the heart — and the position of the pelvic floor change noticeably in a standing position[4]. For example, in healthy patients major veins near the thorax seem to become narrower when standing[5].

Jinzaki argues that while conventional CT scans are very useful for evaluating diseases such as cancer and the hardening of arteries in atherosclerosis, upright CT scans will now be useful for the early detection of disorders related to body functions, such as swallowing, urinating and walking.

For example, upright CTs may "enable the assessment of posture", says Jinzaki. Changes to posture over time can reveal hints about how likely a person is to develop conditions such as osteoarthritis in the knees, which is more likely to develop in those with stooping postures. Jinzaki believes that because of this, upright CT could contribute to the extension of healthy life expectancy in an aging society, and this will lead to upright CTs being adopted more widely across the world in coming years.

WORKFLOW INNOVATIONS

In the aftermath of the pandemic, simplicity of operation and consistency of results have become key drivers in the diagnostic imaging business. Recognizing these needs, Canon Medical System's new user experience platform, INSTINX, improves patient positioning — which is a time-consuming task for technicians. It also increases the accuracy of auto scan planning by up to 97% and reduces the steps involved in the entire workflow by 40%. This cuts the time required for scanning by up to 24%.

In addition to improving image quality, "creating an intuitive user experience" is key, says Sastry. This makes new imaging technologies more user-friendly in real clinical practice, he says. ∎

This advertorial was supported by Canon Medical Systems. It may include opinions and impressions based on personal experiences and research findings, which may not necessarily reflect the official position of Canon Medical Systems.

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▲ A computed tomography (CT) image from the lung of a cancer patient (left), and a more detailed image from a new high-resolution CT scanner (right).