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Imaging obese patients using IQon Spectral CT

Abstract

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Abstract

IQon Spectral CT
abdomen, bariatric, Body
Energy, kidney/renal, liver
obese patient, pancreas,
spectral CT, spleen

Purpose of study

The purpose of the study was to evaluate the feasibility of performing dual-energy scans on patients weighing over 260 lbs using IQon Spectral CT. The following is a summary of the study published in Abdominal Radiology by Dr. Toshav and colleagues from Louisiana State University Health Sciences Center New Orleans.

Overview

There are several limitations when imaging obese patients using conventional CT scanners. The tradeoff between achieving high image quality and maintaining radiation dose is a challenge for radiologists. Early introduction of dual-energy CT scanners did not address these obstacles, since both of the source-based solutions (rapid kVp switching and dual-source scanners) rely on acquiring the images at high and low kVp settings. For dual-source systems, the limited FOV on the smaller detector exclusively affects imaging of obese patients. For a rapid kVp switching system, high and low voltages have to be rapidly alternated. Therefore, current cannot be correspondingly alternated to provide adequate numbers of photons at low energy, resulting in higher current settings and higher radiation dose.

Additionally, automated current modulation algorithms cannot be employed, which leads to increased radiation exposure. As a result, these systems limit imaging to patients with BMI less than 30 kg/m², or weighing over 260 lbs. With the introduction of the IQon Spectral CT, signal separation happens at the detector level, which allows the user to scan patients with typical peak voltages of 120 kVp or 140 kVp. IQon Spectral CT allows scanning for patients that weigh over 260 lbs, making the spectral benefits available to the obese patient population.

Methods

The study included a total of 28 patients weighing over 270 lbs with a mean BMI of 48.8 ± 7.8 kg/m². Abdomen pelvis scans were performed on the IQon Spectral CT using tube peak voltage of 120 kVp. Conventional CT, monoenergetic 70 keV (MonoE70), and iodine maps-based reconstructions were performed. Two radiologists with eight years of experience evaluated the conventional and MonoE70 images from the same patient for preference on a Likert scale of -2 to 2, with -2 indicating a strong preference of conventional images and 2 indicating a strong preference for MonoE images. Noise, contrast-to-noise ratio (CNR), and signal-to-noise ratio (SNR) were also measured for both conventional and MonoE70 images by drawing regions of interest (ROIs) on the posterior right lobe of the liver and on subcutaneous fat.

Iodine-based images of different organs like liver, spleen, pancreas, and kidneys were also evaluated by the same two radiologists on a Likert scale of 1-5. A rating of 1 indicates that the iodine map is homogeneous and complete in none or one of the above organs, and a rating of 5 indicates that the iodine map is homogeneous and complete in all of the organs.

Results

Both readers preferred MonoE70 images as compared to conventional images. The overall average image preference score for both readers was 1.64 ± 0.43, which falls between moderate and
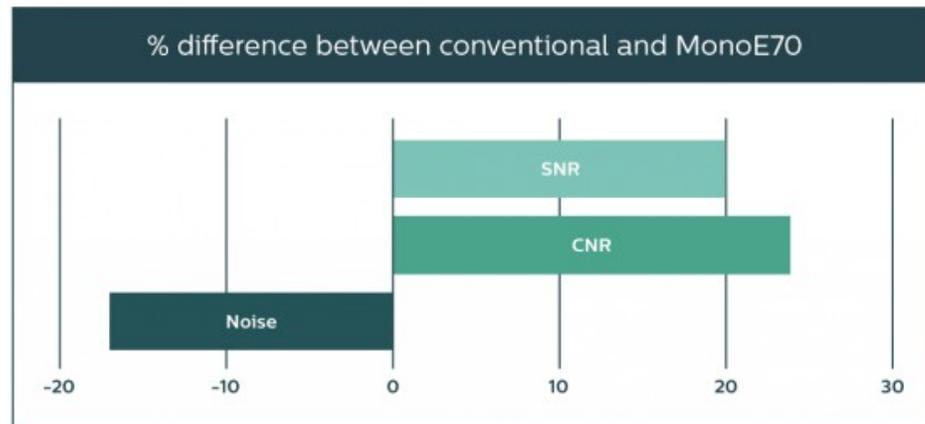
strong preference for MonoE70 images. Noise on MonoE70 images was lower than conventional images (17% lower on MonoE images), and SNR and CNR were higher on MonoE70 images (24% and 20% higher, respectively). The overall average iodine map score for both the readers was 4.59 ± 0.54, with 21 studies receiving a score of 4.5 or 5. There was no correlation between any of the measured subjective and objective parameters, or between patient body habitus markers like weight, height, and circumference.

Conclusion

Patients with body weight over 270 lbs can be scanned and evaluated on the IQon Spectral CT.* MonoE70 images were deemed superior to conventional CT images, exhibiting lower noise and increased CNR and SNR. Iodine maps were complete and available on most of the patients. Additionally, there was no dependency of any spectral results on patient habitus, indicating that all patients can experience the benefits of spectral CT using the IQon Spectral CT, providing an advantage for patient care.
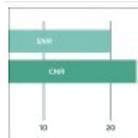
Clinical relevance

IQon Spectral CT can scan entire ranges of patient population, including patients with weight over 270 lbs, and provide improved image quality at MonoE70.

% difference between conventional and MonoE70

* Standard couch weight limit is 450 lbs; bariatric couch weight is 650 lbs.

Atwi, Noah E., et al. "Dual-energy CT in the obese: a preliminary retrospective review to evaluate quality and feasibility of the single source dual-detector implementation." Abdominal Radiology, 2018, doi:10.1007/s00261-018-1774-y.

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