Dual-energy CT may be useful in detecting underlying tumors in patients with an ICH of unknown origin, and is a useful tool in differentiating between tumor bleeding and pure ICH in patients with acute ICH of an unclear origin [1)].

The idea behind Dual Source CT is as simple as it is ingenious: It is merely using two X-ray sources and two detectors at the same time. The result? You get double temporal resolution, double speed, and twice the power, while lowering dose even further. It provides images of exceptional quality and is an amazing tool to explore new clinical opportunities. The benefits that Dual Source CT holds for you and your patients are astounding. SOMATOM® Definition allows you to scan any heart at any heart rate without the need of beta-blockers – at the lowest radiation dose ever achieved in Siemens CT. Moreover, it provides one-stop diagnoses, regardless of size*, condition, and heart rate of the patient, saving precious time and money in acute care. And imagine all the additional clinical opportunities Spiral Dual Energy scanning offers in CT by characterizing materials in a single scan. Reaching excellence in CT is not only about having the most innovative scanner: It is also about pushing clinical boundaries to a higher level, providing advantages nobody wants to miss. We make a difference by offering a complete and comprehensive solution dedicated to all clinical needs, by turning complex examinations into easy CT routine.

Dual Energy CT It has always been an aim to collect as much information as possible for differentiation of tissues. Providing Spiral Dual Energy scanning, SOMATOM Definition opens the door to a new world of characterization, visualizing the chemical composition of material. The idea of Dual Energy is not new to the CT community. Earlier approaches, including two subsequent scans at different tube voltages or two subsequent scans at the same position, failed to seamlessly align the imaged anatomy and to capture the same phase of contrast enhancement. SOMATOM Definition overcomes this limitation by permitting the use of two X-ray sources at two different kV levels simultaneously. The result is two spiral data sets acquired simultaneously in a single scan providing diverse information, which allows you to differentiate, characterize, isolate, and distinguish the imaged tissue and material. Many applications are already available for daily clinical use, such as an accurate subtraction of bone in CTAs, assessment of pulmonary perfusion, characterization of kidney stones or iodine removal from liver scans to generate a virtual unenhanced image. What’s more, new applications continuously increase the clinical value of Dual Energy CT, for example characterization of atherosclerotic plaques or assessment of myocardial perfusion. By enabling not only faster and more reliable diagnoses, but also by further broadening the application spectrum of CT, Spiral Dual Energy makes a difference for everybody’s daily work. Clinical Benefits • Direct subtraction of bone even in complicated anatomical regions. • Display of atherosclerotic plaques. • Virtual unenhanced images. • Evaluation of lung perfusion. • Display of lung vessels affected by pulmonary emboli. • Visualization of tendons and ligaments. • Kidney stone characterization. • Visualization of iodine concentration in the myocardium. • Differentiation between old and fresh intracranial bleedings. • Visualization of uric acid crystals in peripheral extremities.

How Dual Energy CT Works The X-ray tube’s kilo voltage (kV) determines the average energy of the photons in the X-ray beam. Changing the tube potential results in an alteration of photon energy and a corresponding modification of the attenuation of the X-ray beam in the materials scanned. In other words, X-ray absorption is energy- dependent, for example, scanning an object with 80 kV results in a different attenuation than with 140 kV. In addition, this attenuation also depends on the type of material or tissue scanned. Iodine, for instance, has its maximum attenuation at low energy, while its CT-density is only about half in high-energy scans. The attenuation of bones, on the other hand, changes much less when scanned with low photon energies compared to high-voltage examinations. Spiral Dual Energy CT exploits this effect: Two X-ray sources running simultaneously at different voltages acquire two data sets showing different attenuation levels. In the resulting images, the material-specific difference in attenuation makes a classification of the elementary chemical

composition of the scanned tissue feasible. Depending on the clinical question, the images obtained at 140 and 80 kV potential are further processed with specific software algorithms implemented in the syngo Dual Energy software. In addition, fused images are provided for initial diagnosis. These are created as weighted average which have a low image noise and a normal attenuation like images scanned at 120 kV tube potential.

Direct Angiography and Bone Removal with Plaque Highlighting syngo Dual Energy Direct Angio with Bone Removal As a minimally invasive procedure in comparison to DSA, multislice spiral CT (MSCT) has become the first-line modality for many angiographic applications. For routine practice and especially in the emergency room, CTA is the standard of care because it is less time consuming, less susceptible to motion artifacts, and much less prone to complications. Today, MSCT is the standard modality in the detection of aortic aneurysms, especially in emergencies, when pulmonary embolism, acute heart attack, and aortic dissection need to be ruled out by CT simultaneously. Visualization of the aorta is possible beyond the vessel wall, also showing, for example, intramural thrombi or periaortic infections. The latest technical evolution of MSCT to DSCT makes direct bone removal possible based on a spectral differentiation between iodine and bone in Dual Energy CT. Thus, a direct visualization of the aorta and branching vessels is feasible. Moreover, MSCT is the perfect tool for pre- and postoperative assessment and evaluation with endovascular aortic repair (EVAR), and Dual Energy CT can help to differentiate endoleaks from calcifications in the thrombosed lumen. In neurovascular angiography, the immediate availability and fast exam in MSCT have also proven highly beneficial in the non-invasive investigation of supra-aortic extracranial and intracranial vessels for the assessment of acute stroke. Recent studies show that supraaortic CT angiography (CTA) is also ideally suited for the detection of intracranial aneurysms of 3 mm and larger in cases of subarachnoidal hemorrhage. With dual energy material differentiation, it has also become possible to perform reliable bone and calcified plaque subtraction out of CTA volume data, so that aneurysms in close vicinity to the skull base are more easily identified. CT angiography is also gaining importance in the assessment of peripheral arterial occlusive disease. Dual Energy CT can help to cope with those huge datasets exceeding 1,000 images by generating a single maximum intensity projection without the superimposition of bones. Additionally, plaques can be identified and removed or highlighted in this image to support the grading of stenoses and to assist therapeutic planning.

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Kim SJ, Lim HK, Lee HY, Choi CG, Lee DH, Suh DC, Kim SM, Kim JK, Krauss B. Dual-energy CT in the evaluation of intracerebral hemorrhage of unknown origin: differentiation between tumor bleeding and pure hemorrhage. AJNR Am J Neuroradiol. 2012;33:865–872.