

### Healthcare Sector Imaging & IT Division

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#### **New diagnostic method for gout: Dual Energy Computed tomography instead of joint aspiration**

**The most reliable method of diagnosing gout is to aspirate the joint in order to obtain fluid to verify the presence of monosodium urate crystals (uric acid). Up to now, computed tomography (CT) has played a limited role in the evaluation of gout, since conventional CT systems cannot reliably verify deposits of uric acid. However, a current study at the Vancouver General Hospital in Canada gives rise to speculation that dual-energy computed tomography (DECT) could radically change the management of this disease. DECT enables fast, noninvasive examinations and, based on initial evaluations, has the potential to surpass the clinical examination in terms of identifying subclinical disease.. Investigations have confirmed the high sensitivity of the DECT method in detecting uric acid deposits. The Canadian scientists used the SOMATOM Definition computed tomography (CT scanner) from Siemens for their investigation. This system is the only CT scanner worldwide that features two X-ray tubes capable of simultaneously producing different energies.**

Gout is the most widespread form of crystal arthropathy and the most common inflammatory joint disease in men. It is caused by the deposition of uric acid crystals in and around joints and predominantly occurs among men. 2.1 million people in the USA and some 1.5 million people in Germany are currently afflicted by this painful, destructive disease. Furthermore, due to our eating habits, these figures are constantly increasing.

The classical symptoms of gout are painful, visibly swollen joints. Gout is nevertheless difficult to diagnose, since quite a few diseases, for example various forms of arthritis, have similar symptoms. While imaging techniques can help to locate gout lesions, the specificity of X-ray, single-source computed tomography, magnetic resonance imaging and ultrasound is not sufficient to definitively confirm a diagnosis. Certainty can be achieved only by verifying the presence of mono sodium urate crystals, also called uric acid deposits (tophi), in and around the joint. This is

done by aspirating the joint with a needle to remove the fluid, which is then microscopically analyzed under polarized light. A joint puncture may be difficult with acutely inflamed joints, since the amount of fluid available may not be sufficient for this purpose. Furthermore, some anatomical regions are difficult to access, for example in the spinal region. A noninvasive diagnostic technique is therefore extremely desirable.

The prospect of a fast, safe and noninvasive diagnosis of gout using dual-energy computed tomography (DECT) has sparked great interest in Canada. In collaboration with Siemens, Dr. Savvas Nicolaou, Director of Emergency Radiology at Vancouver General Hospital and Associate Professor at the University of British Columbia in Vancouver, and both his radiology and rheumatology colleagues developed a dual-energy algorithm for identifying uric acid deposits in gout.

The Canadian scientists used a SOMATOM Definition from Siemens for their trials. This system is the only CT scanner worldwide that features two X-ray tubes capable of simultaneously producing different energies. The team performed scans at different energies to determine the attenuation values of uric acid deposits. Siemens used this data to develop a new dual-energy protocol for gout that now can be used by any physician. The software algorithm used to detect gout via DECT is based on the realization that the CT values of uric acid deposits are lower, for instance, than those of calcium if scans are performed at different energies (80 and 140 kilovolts). Through color coding of the different attenuation values, it then becomes possible to recognize mono sodium urate crystals on the clinical CT image: The uric acid crystals indicating gout are, for example, color coded in red, while other bone formations and calcium are displayed in blue. The commercial version of the Siemens application is called Syngo DE Gout.

In a further study, Dr. Nicolaou and his colleagues investigated whether DECT can be used reliably to confirm the presence of gout tophi, whether DECT is superior to the traditional clinical examination ie detecting subclinical urate deposits, and whether this modality can clarify cases of doubt as a problem solving tool. Ten patients were recruited who already had been diagnosed with gout by means of joint puncture with aspiration of synovial fluid and 10 control patients that did not have gout clinically. The patient records of all patients were analyzed and all patients underwent a complete rheumatological examination and DECT. The evaluation of the DECT images was performed by two radiologists working independently of one another.

This study showed that the DECT images of all patients proven to have gout yielded correspondingly positive findings in the aspirated joints. The DECT images of the control group all

showed negative findings. "Our findings indicate that deposits of mono sodium urate crystals can be detected sub clinically more efficiently using DECT than with the traditional clinical examination," says Dr. Nicolaou. The fact is that more areas involved with gout were found overall per DECT than through the other clinical examination ,ie 200 sites with DECT versus 53 sites clinically, ie four times more foci were revealed with DECT(p < 0.05). Furthermore, it has become evident that DECT can detect the presence of gout in hands, wrists feet, ankles, knees significantly better than the traditional clinical examination. DECT did not achieve significantly better results in the detection of gout in the elbow.

In addition, the study also provided new information on the presence of subclinical tophi and the accumulation of monosodium urate crystal deposits in clinically challenging anatomic regions. "To our surprise, the study showed that uric acid can be initially deposited in tendons and ligaments near and within the knee joint, ankle joint ,wrist , ie in the collateral ligament / cruciate ligament and deep flexor tendons of the wrist", says Dr. Nicolaou. "This is very important to know, since these deposits can increase the susceptibility of tendons and ligaments for tears. If we are able to detect the disease in an early stage, we can initiate a treatment to prevent destruction of the tendons and ligaments and joints where subclinical tophi are present."

"DECT is a promising new technique that can in a reliable, noninvasive fashion confirm the presence of gout tophi subclinically, provide information on the patient's disease burden and enable differentiation from other diseases. This technique may be used for monitoring treatment success and can be used to resolve unclear cases", says Dr. Nicolaou. However more research is required to more clearly define DECT role in the management of Gout.

Picture link: <http://www.siemens.com/med-picture/gout>

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