



CUSTOMER SPOTLIGHT

SPECT/CT May Help to Evaluate Arthritic Activity in Small Joints

Results of rheumatoid arthritis study presented at SNMMI 2016

As a leading healthcare facility in Korea, Seoul National University Hospital (SNUH) has a rich tradition of adopting new technologies and advancing medical services. Established in 1946, just after independence from Japan, SNUH became the affiliate hospital to Seoul National University College of Medicine. In 1977, the new 14-story modernized hospital was built, making SNUH the largest hospital in Northeast Asia at the time.

The Department of Nuclear Medicine at SNUH is dedicated to improving health through excellence in patient care, education, and research. As a world-leading group in the field of nuclear medicine, SNUH provides an array of diagnostic services utilizing PET/CT, SPECT, and SPECT/CT.

As a leading research institution, SNUH typically presents 20-30 research articles at the annual meeting of the Society of Nuclear Medicine and Molecular Imaging. Within the Department of Nuclear Medicine, education and research is then applied to clinical diagnosis and treatment. Gi Jeong Cheon, MD, a nuclear medicine physician

and molecular imaging scientist, is interested in studying tailored patient therapy using combined imaging modalities.

In 2011 and 2012, three Discovery™ NM/CT 670 systems were installed at SNUH. With the inherent capability of both SPECT and CT to help clinicians evaluate bone injuries and diseases, Dr. Cheon embarked on a study using the new system to determine if it could help evaluate arthritic activity in the hand. His goal was to develop an objective evaluation of arthritic activity based on quantitative values that could help guide patient treatment. Currently, the gold standard for evaluating arthritic patients is a visual analog scale (VAS) performed by a rheumatologist.

Quantitation, an integral component of Dr. Cheon's research, is enabled by Q.Metrix. Q.Metrix, a user-friendly application for measuring and reporting standard uptake values in SPECT images (SPECT SUVs) in the organ or lesion of interest, enables personalized, quantitative SPECT SUV results with multi-dimensional organ and lesion characterization.

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Dr. Gi Jeong Cheon



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“We want to determine the feasibility of a quantitative assessment using the SPECT bone scan and CT,” Dr. Cheon says. “With the bone scan, we can assess the arthritic activity in the small joint. Measurements of quantitative values, such as SPECT SUV, are more objective and may be helpful for the clinical scoring and could help guide patient management.”

While PET/CT and MRI can also quantify bone changes, Dr. Cheon says these resources are limited and also very expensive compared to SPECT/CT for bone imaging. Bone imaging using a Tc-99m labeled bone tracer, such as Tc-99m methylene diphosphonate (MDP), has been widely used for the assessment of musculoskeletal disease and malignancies including skeletal metastasis.

SPECT/CT employs advantages of both imaging modalities, such as high sensitivity from a SPECT scan and precise localization from a CT scan.

However, it is not easy to quantitate uptake of a SPECT tracer because of attenuation and scatter of emitted photons. There are clinical needs to evaluate disease activity quantitatively in conditions such as arthritis. Dr. Cheon chose to study the use of SPECT/CT

quantification in small joints of the hands because small joints are difficult to assess the disease activity of arthritis when using only planar or SPECT imaging. In addition, quantifying the evaluation of the small joints of hands is very limited in many cases, due to the small volume of diseased regions. However, these joints are less impacted and can be evaluated in a single scan compared to the other regions of the body. “As expected, the findings of small joints on SPECT/CT are less ambiguous for evaluation of arthritic activity than large joints, such as the knee or shoulder,” he adds.

Based on a study with rheumatoid arthritis patients, Dr. Cheon has found that the SPECT/CT quantitative imaging study has a good correlation to the VAS test. The study was presented at the 2016 annual congress meeting of the Society of Nuclear Medicine and Molecular Imaging (SNMMI) in San Diego, CA.

Clinical case report

In this report, a case of a small joint rheumatoid arthritis and a healthy control is compared using Q.Metrix (Figure 1).

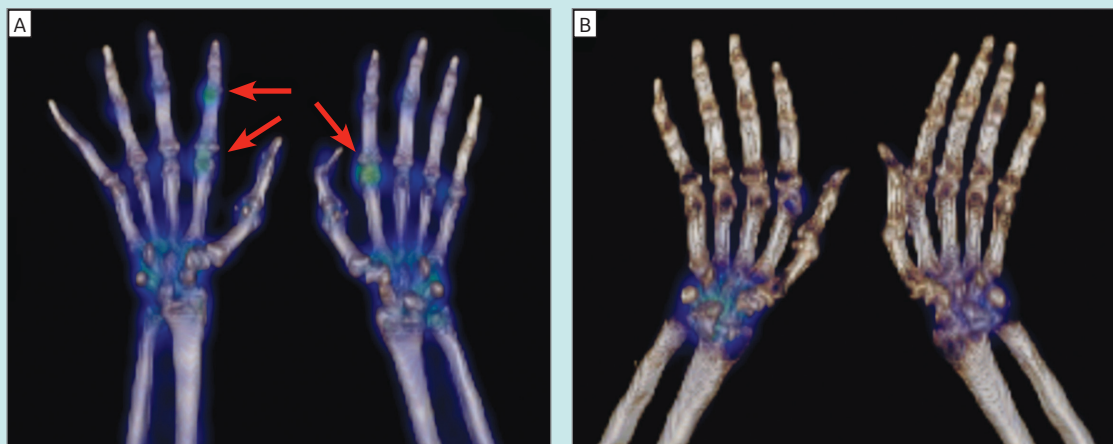


Figure 1. (A) Rheumatoid arthritis patient: SPECT/CT scan, Tc-99m MDP; mild uptake in the right 2nd PIP (SPECT SUV_{max} 1.67), right 2nd MCP (SPECT SUV_{max} 1.32), and left 2nd MCP (SPECT SUV_{max} 1.93) joint. (B) Healthy control participant: SPECT/CT scan, Tc-99m MDP; no abnormal radioactivity in the small joints of both hands.

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A 21-year-old female patient presented with painful swelling on her 2nd and 3rd proximal interphalangeal (PIP) joints. She was diagnosed as early stage seropositive rheumatoid arthritis (RA) based on laboratory tests that revealed a rheumatoid factor (RF) positive (130 IU/mL) and anti-cyclic citrullinated peptide antibody (anti-CCP) positive (200 IU/mL). After use of methotrexate 7.5 mg once per a week, the symptoms subsided. One year later, the patient felt pain again on right 2nd PIP joint, although there was no tenderness.

Positive findings were shown on hand SPECT/CT and MRI scans; there was no abnormality detected in an X-ray exam. There was relatively high uptake in the right 2nd metacarpophalangeal (MCP) (SPECT SUV_{max} 1.32), right 2nd PIP (SPECT SUV_{max} 1.67), and left 2nd MCP (SPECT SUV_{max} 1.93) on a SPECT/CT scan. Average SPECT SUV_{max} and standard deviation of remaining lesions were 0.91 and 0.21, respectively. Positive lesions visualized on the MRI were also on the right 2nd PIP, right 2nd MCP, right 4th MCP, left 2nd MCP, and left 3rd PIP joints, which were graded by RA-MRI scoring (RAMRIS) system (normal, 0; mild, 1; moderate, 2; severe, 3) as 3, 1, 1, 1, and 1, respectively. Although pain reappeared in the right 2nd PIP joint with high grade from RAMRIS, the right 2nd PIP joint had mild uptake (SPECT SUV_{max} 1.67) and no tenderness. Therefore, the patient's physician decided to maintain the prescribed methotrexate medication with further planned follow-up. Contrary to the rheumatoid patient, in the 45-year-old healthy control, the mean values, and standard deviation of SPECT SUV_{max} of small hand joints were 0.93 and 0.19, respectively.*

Value of SPECT/CT Quantitation

“We are convinced that the use of quantitative SPECT/CT may help to improve the sensitivity of the detection of active arthritic regions,” Dr. Cheon says. “It may also help increase the confidence in the diagnosis by nuclear medicine physicians due to the quantitative value.”

Although MRI is regarded as the gold standard for musculoskeletal assessment, the grading system from MRI is subjective, adds Dr. Cheon. “Our data suggests that quantitation of uptake on SPECT/CT may have a complementary role to MRI for assessment of musculoskeletal disease activity, especially in small joints. SPECT/CT is now being regarded as a useful tool for musculoskeletal disease assessment with advantages of high sensitivity and less expensive cost compared to MRI.”

While Dr. Cheon acknowledges he is in the very early stage of examining a new application for SPECT/CT with a small study size, he is very excited at the initial results and hopes that a larger patient sample size will further validate his current results.

Dr. Cheon also sees great opportunity in utilizing quantitative SPECT/CT to assess the therapeutic response of new arthritic drugs. “Because we can obtain the quantitative value in an objective manner, SPECT/CT and Q.Metrix may be utilized in clinical drug trials or other clinical studies evaluating response to treatment.” ■

* Various studies have illustrated that SPECT SUV may have potential clinical importance, and its clinical value has not yet been demonstrated. The clinician is ultimately responsible for the final interpretation and diagnosis based on standard practices and visual interpretation of all SPECT data.