X-Ray Analysis Predicts Knee OA Progression

ARTICLES BY
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FROM THE WORLD CONGRESS ON OSTEOARTHRITIS

BRUSSELS – Analysis of plain x-ray images of knee joints from 60 patients with osteoarthritis confirmed that a novel method for assessing bone trabecular structure adjacent to knee joints provides a reliable prediction of future disease progression.

Assessment of bone trabecular integrity by fractal signature analysis "provides an osteoarthritis imaging biomarker that is a prognostic marker of knee osteoarthritis progression," Dr. Virginia Byers Kraus said at the congress.

Baseline bone trabecular integrity predicted roughly 85% of the change in joint space area during 2 years of follow-up in patients with osteoarthritis (OA). The new study, which used x-rays from 60 patients with OA and 67 controls, is the second report to document the prognostic accuracy of fractal signature analysis of bone trabecular integrity in OA patients.

The first report, also from Dr. Kraus and her associates, came out last year, and involved 138 OA patients who were followed for 3 years (Arthritis Rheum. 2009;60:3711-22).

"The next step is to compare fractal signature analysis head to head with MRI and look at its ability to predict MRI changes" in OA patients, and "its ability to identify OA in the preradiographic stage," she said in an interview.

VITALS

Major Finding: Bone trabecular integrity, assessed by fractal signature analysis of plain radiographs, correctly predicted about 85% of the joint space change in patients with knee OA.

Data Source: Review of radiographs taken from 60 patients with OA and 67 controls at baseline and at 12 and 24 months' follow-up.

Disclosures: Dr. Kraus said that she had no relevant disclosures. One coauthor is an employee of Optasia Medical; Optasia provided the software used for the radiograph analyses. Another coauthor is an employee of Pfizer; Pfizer supplied the database used in the study.

Fractal signature analysis of bone trabecular integrity using x-ray images "gives you the ability to more fully phenotype patients than we've been able to, and it is less costly than MRI," said Dr. Kraus, a rheumatologist and professor of medicine at Duke University in Durham, N.C. "It's very promising for identifying patients at high risk for progression in [an intervention] trial, and possibly to screen patients in the clinic."

Fractal signature analysis evaluates the complexity of detail of a two-dimensional image. Past studies have successfully used the method to assess osteoporosis and arthritis of the spine, hip, wrists, hands, and knees before and after surgery. Fractal signature analysis has the major advantage of not being very sensitive to image-acquisition quality.

Although fractal signature analysis involves a complex statistical analysis of x-ray image data of bone structure adjacent to a patient's knee joint, Dr. Kraus and her associates incorporated that analysis into "KneeAnalyzer" software developed by Optasia Medical, a British company. Now that the software exists, "it is easy to use. It's just a tool to get at bone trabecular integrity. I think it can easily be widely adopted," she said.

The new study used data collected in a nontherapeutic methods trial sponsored by Pfizer Inc. The data set included 60 women with knee OA whose average age was 58 years and whose average body mass index was 35.6 kg/m^2. (All participants in this study arm had a BMI of at least 30.) The 67 controls had an average age of 55 years and all had a BMI of 28 or less, and all had no knee symptoms, no radiographic signs of knee OA, and no history of knee fracture, surgery, or disease.

The researchers assessed bone trabecular integrity using fractal signature analysis on radiographs taken at baseline and at 12 and 24 months. The baseline measurements in the vertical dimension of bone trabecular integrity predicted changes in joint space area at 12 and 24 months, and in joint space width at 24 months. Baseline measures in the horizontal dimension were not predictive. The predicted changes based on baseline bone trabecular integrity accounted for 85%-87% of the actual change in joint space area over 24 months, Dr. Kraus reported at the congress, which was organized by the Osteoarthritis Research Society International. ■

Vitamin K Deficiency May Play a Role in Osteoarthritis of the Knee

FROM THE WORLD CONGRESS ON OSTEOARTHRITIS

BRUSSELS – Vitamin K deficiency may increase the risk for developing knee osteoarthritis and for forming knee cartilage lesions, judging from the findings of a 30-month study of nearly 1,200 people at risk for knee osteoarthritis.

This apparent role of low vitamin K levels in susceptibility to knee pathology raised the question of whether vitamin K supplementation for deficient individuals might be a "simple, effective preventive agent," Dr. Tuhina Neogi said at the congress.

"The next step is an intervention trial," said Dr. Neogi, a rheumatologist at Boston University. "Taken together, there is enough biological plausibility that vitamin K could play a role. … If [dietary supplementation] proves effective, it would be something easy for people to do for themselves."

Results from prior studies showed that low vitamin K intake and low blood levels were linked with prevalent radiographic features of hand and knee osteoarthritis. The new study made the first longitudinal examination of a potential link between plasma levels of vitamin K at baseline and incident osteoarthritis and associated pathology.

The investigators examined data that was collected from 1,180 people who had an elevated risk for knee osteoarthritis at entry but had not yet developed the disease. They averaged 62 years of age; 62% were women, and their average body mass index was about 30 kg/m^2. Dr. Neogi and her associates defined vitamin K deficiency as a plasma level of phylloquinone less than 0.5 nmol/L. (Normal is 0.5-1.2 nmol/L.) At baseline, 9% of the study participants without osteoarthritis had vitamin K deficiency.

The researchers made incidence osteoarthritis the primary end point, defined as development of a knee Kellgren-Lawrence (KL) grade of 2 or higher (including knee replacement). All people included in the analysis had a KL grade less than 2 at baseline. During 30 months of follow-up, 15% of the participants developed osteoarthritis.

In an analysis of whether or not participants developed knee osteoarthritis, those with vitamin K deficiency at baseline had a 43% increased risk, after adjustment for age, sex, BMI, bone mineral density, and vitamin D level at baseline. This increased risk just missed reaching statistical significance. Dr. Neogi suggested that this may have been a power issue, with too few vitamin K–deficient participants in the database.

An additional analysis that took into account the extent of knee osteoarthritis showed statistically significant links with vitamin K deficiency.

Those who developed osteoarthritis in both knees had a significant, nearly threefold increased risk of having vitamin K deficiency at baseline, compared with those who developed osteoarthritis in one knee during follow-up. Those who had both knees affected at follow-up had a significant, twofold increased risk of vitamin deficiency, compared with people who did not develop any knee osteoarthritis, she reported at the congress, which was organized by the Osteoarthritis Research Society International.

The vitamin K–deficient participants also had a statistically significant, nearly threefold increased risk of developing new cartilage lesions on their knee MRI scans that were consistent with developing osteoarthritis. They also had a 77% increased risk for showing osteophytes on their follow-up MRI scans, but this difference was not statistically significant

Dr. Neogi said that she had no disclosures. ■

Hip-Prosthesis Revision Rate Drops With Age

FROM THE WORLD CONGRESS ON OSTEOARTHRITIS

BRUSSELS – When younger patients receive a total hip replacement, they are more likely to eventually need revision surgery, compared with older patients, according to findings from a 12-year follow-up study of more than 58,000 Medicare patients.

The finding makes sense and comes as no surprise, but the documentation of a link between younger age and increased revision rates has important implications for prosthesis design.

"As total hip replacement indications extend to increasingly younger populations, [the patients'] mortality risk will diminish, and a vast majority will remain at risk for revision for decades," Dr. Jeffrey N. Katz said at the congress.

"Research evaluating technical innovations to increase prosthesis longevity should recognize the competing risk of mortality. In a 75- or 80-year-old, revision is a rather infrequent event; their implant will likely outsurvive them. The older a patient is, the more likely the patient is to die with their original prosthesis intact," said Dr. Katz, director of the orthopedic and arthritis center for outcomes research at Brigham and Women's Hospital, Boston.

"If a prosthesis manufacturer wants to increase the longevity of a prosthesis, the patients to target are those younger than 65. For patients who get through the perioperative period, the real issue is biomaterials: How likely are the biomaterials to wear out over time?" he noted.

Currently, about 280,000 total hip replacements are performed in the United States annually (more than 90% because of osteoarthritis), along with 40,000 revision hip surgeries each year. Revisions alone cost more than $1 billion annually.

Dr. Katz and his associates studied the 58,521 Medicare beneficiaries who underwent a total hip replacement dur-

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ing July 1995–June 1996. Two-thirds were women, and 60% were aged 65-75 years, with the remaining patients older than 75 years. The researchers had complete follow-up records for all patients for the subsequent 12 years, through 2008.

During follow-up, 60% of the patients who were older than 75 years at the time of surgery died; during the 12-year follow-up, the survivors had a revision rate of 9%. Among patients aged 65-75 years at the time of their initial hip surgery, 30% died during follow-up, with the survivors having a 13% revision rate. In both age groups, men had a higher revision rate than did women.

'In a 75- or 80-year-old, revision is a rather infrequent event; their implant will likely outsurvive them.'

DR. KATZ

"Younger patients are more active and heavier," Dr. Katz said in an interview at the congress, which was organized by the Osteoarthritis Research Society International.

"Younger patients probably wear [prosthetic] joints out faster, and – given the same amount of wear – they are offered [revision] surgery more frequently. … We don't have data for 45- to 65-year-olds, but by extension, their mortality is unlikely over the following 20 years, while a revision is likely," Dr. Katz said. ■

VITALS

Major Finding: During 12 years of follow-up, patients aged 65-75 years had a 13% revision rate following total hip replacement. Patients older than 75 years at the time of their initial hip replacement had a 9% rate of revision surgery during the same 12-year follow-up.

Data Source: Medicare records for 58,521 beneficiaries who had total hip replacement surgery during July 1995–June 1996 and who were followed through 2008.

Disclosures: Dr. Katz said that he had no disclosures.