EXTENDED REPORT

Ultrasound-detected inflammation predicts radiographic progression in hand osteoarthritis after 5 years

Alexander Mathiessen, Barbara Slatkowsky-Christensen, Tore K Kvien, Hilde Berner Hammer, Ida K Haugen

ABSTRACT

Objective To examine whether ultrasound predicts radiographic hand osteoarthritis (OA) progression after 5 years.

Methods We included 78 participants (71 women, mean (SD) age 67.8 (5.2) years) from the Oslo Hand OA cohort with ultrasound examination (gray-scale (GS) synovitis and power Doppler (PD) signals) at baseline and conventional radiographs and clinical examination at baseline and 5-year follow-up. Radiographic progression was defined as an increase in global OA according to the Kellgren–Lawrence (KL) scale or progression of individual radiographic OA features. We examined whether baseline ultrasound features and clinical examination predicted radiographic progression using generalised estimating equations, adjusted for age, sex, body mass index and follow-up time.

Results Radiographic progression occurred in 17.9% joints for KL, 12.1% for joint space narrowing, 11.7% for osteophytes and 4.5% for erosions. Ultrasound-detected inflammation predicted KL progression, and dose–response associations were observed for GS synovitis grade 1 (OR=2.8, 95% CI 1.8 to 4.2), grade 2 (OR=3.6, 95% CI 2.2 to 5.8) and grade 3 (OR=15.2, 95% CI 6.9 to 33.6), and for PD signal grade 1 (OR=2.9, 95% CI 1.2 to 6.8) and grades 2–3 (OR=12.0, 95% CI 3.5 to 41.0). Significant associations were also observed between ultrasound inflammation and progression of all individual radiographic features, and between clinical soft tissue swelling at baseline and radiographic progression.

Conclusions Ultrasound-detected GS synovitis and PD signals were significantly associated with radiographic progression after 5 years. This study supports the use of ultrasound as a tool to detect patients with hand OA who are likely to progress.

INTRODUCTION

Hand osteoarthritis (OA) is a progressive and common rheumatic disorder accompanied by pain and disability. With an ageing and expanding population, the disease will continue to burden our society unless we are able to identify targets that will slow down or halt disease progression.

Currently, conventional radiography is the most easily available imaging modality for assessment of structural hand OA features. However, radiographs have important limitations, such as the inability to view soft tissue structures and inflammation, and have poor association with clinical symptoms.

Once considered a ‘wear and tear’ disease, OA has been found to be a complex disorder in which also the synovium plays a pivotal role. Histological changes that occur in OA synovium include increased vascularity, inflammatory cell infiltration and deposit of inflammatory mediators comparable to that observed in rheumatoid arthritis (RA). Modern imaging techniques such as MRI and ultrasound are promising tools for detecting OA synovitis and demonstrate high prevalence of synovitis in painful hand OA joints.

Attention has now turned to the prognostic value of synovitis. Some studies on knee OA suggest that the presence of synovitis seen by arthroscopy, MRI and ultrasound may be a surrogate marker of OA severity and associated with increased risk of disease progression. A similar predictive correlation is less clear for hand OA due to few longitudinal studies. However, a recent study by suggested that baseline inflammatory ultrasound features were associated with radiographic progression of osteophytes and joint space narrowing (JSN) after 2.3 years. We wanted to explore these associations further by extending the number of radiographic variables and the time of follow-up. Hence, our present aim was to examine whether ultrasound features including gray-scale (GS) synovitis and power Doppler (PD) activity can predict radiographic progression after 5 years in patients with hand OA.

METHODS

Patients

The Oslo Hand OA cohort consists of patients with hand OA recruited from the rheumatology outpatient clinic at Diakonhjemmet Hospital in 2001–2003 (n=209; see online supplementary figure S1). Patients between 50 and 70 years of age with hand OA were eligible to be enrolled in the cohort if they did not have any other rheumatic diseases (eg, RA or psoriatic arthritis). The participants were invited to a follow-up examination in 2008–2009 (n=128) and a second follow-up in 2013 (n=87).

In the current longitudinal analyses, we used data from 2008 to 2009 (hereafter referred to as ‘baseline’) and 2013 (hereafter referred to as ‘follow-up’). We included 78 participants (71 women, mean (SD) age 67.8 (5.2) years) with available ultrasound examination at baseline and...
conventional radiography and questionnaires at baseline and 5-year follow-up. Among the 87 participants who attended the examination in 2013, no significant differences were observed between those who were included (n=78) and not included (n=9) in the analyses regarding sex distribution (p=0.35), mean age (p=0.59) or Kellgren–Lawrence (KL) sum score at follow-up (p=0.76).

Ultrasound

Ultrasound was performed using a Siemens Antares Sonoline machine (Siemens Medical Solutions, Mountain View, California, USA) with a 5–13 MHz linear array transducer (optimised for PD with pulse repetition frequency 391 Hz, low wall filter and frequency 7.3 MHz). To ensure standardisation, fixed settings was applied and the same ultrasound machine without software upgrading was used throughout the study.

The scanning protocol is previously described in detail. One trainee (AM) and one experienced rheumatologist (HBH) performed the ultrasound assessments together and reached consensus on each scoring. Each subject had 30 joints imaged: bilateral first carpometacarpal joints, first to fifth metacarpophalangeal joints, first to fifth proximal interphalangeal joints and second to fifth distal interphalangeal joints. The sonographers were blinded for the results of the other assessments.

GS synovitis and PD activity in finger joints were scored according to a semiquantitative scoring system with 0=none, 1=minor, 2=moderate and 3=major presence of ultrasound pathology, as demonstrated in a previously published imaging atlas. GS synovitis was defined as a combined score of thickened synovium and joint effusion, while PD activity represented the presence of vascularisation.

A reliability exercise was performed; one of the authors (IKH) randomly selected images of GS synovitis (n=103) and PD signals (n=20). Blinded to previous scoring results, AM and HBH separately performed two scorings (1 week apart) with use of reference atlas. The exercise demonstrated good inter-reader reliability for synovitis (κw=0.74) and very good reliability for PD (κw>0.93). Intra-reader reliability was ‘very good’ for both features (κw>0.86).

Conventional radiography

Bilateral hand radiographs (posteroanterior view) were obtained at baseline and follow-up. One reader (IKH) scored the paired hand radiographs (30 joints, same as ultrasound) with known time sequence for global OA severity according to the KL scale (grade 0–4). The radiographs were also scored for individual radiographic features according to the Osteoarthritis Research Society International atlas, including JSN (grade 0–3), osteophytes (grade 0–3) and erosions (absent/present). The reader was blinded for clinical information and ultrasound findings, and has previously demonstrated ‘good’ to ‘very good’ intra-reader reliability for both radiographic status and change scores.

Clinical examination

One experienced rheumatologist (BS-C), blinded to imaging results, performed a clinical examination of soft tissue swelling in all finger joints bilaterally, assessed as ‘absent’ or ‘present’.

Statistics

Data were summarised using the mean (SD) for normally distributed continuous variables. Differences in demographics, ultrasound features and radiographic severity between included and non-included participants and participants with and without erosions were calculated using the Mann–Whitney U test. Differences on joint level were compared using Pearson’s χ2 test.

At joint level, we examined whether baseline ultrasound features (independent variables) could predict radiographic progression (dependent variables) in the same joint after 5 years using logistic regression with generalised estimating equations (GEE) and an exchangeable correlation matrix, presented as ORs with 95% CIs. Joints without the current ultrasound features served as reference. Due to few joints presenting with moderate and severe PD signals (n=25), PD grades 2 and 3 were combined as one score in the analyses.

We used four definitions of radiographic progression: (1) increasing global OA severity (Kellgren–Lawrence grade (KLG) change ≥1 in joints with baseline KLG=0–3); (2) progression of osteophytes (osteophyte change ≥1 in joints with baseline osteophyte=0–2); (3) progression of JSN (JSN change ≥1 in joints with baseline JSN=0–2) and (4) incident radiographic erosions in joints without erosions at baseline. Joints with no potential for progression from baseline (ie, KLG=4, JSN=3, osteophyte=3 and presence of erosions) were excluded from the respective analyses. Missing joints due to unilateral hand radiographs (n=3 participants) and joints treated with surgery (mainly trapezeectomy) during follow-up (n=13) were not included in the regression analyses. We adjusted for age, sex and body mass index at baseline and for follow-up time, and repeated the analyses with further adjustment for baseline KL grade. Analyses on erosive development were additionally adjusted for absence/presence of other erosive joints at baseline.

All statistical analyses were performed by use of SPSS Statistics V21.0 (IBM SPSS, Chicago, Illinois, USA).

RESULTS

Baseline demographics and clinical characteristics are presented in table 1. The mean (SD) follow-up time was 4.7 (0.4) years.

Table 1 Baseline demographic, clinical, ultrasonographic and radiographic data of 78 patients with hand osteoarthritis (OA)

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>Sex, n (%) female</th>
<th>Age, mean (SD) years</th>
<th>Fulfilling ACR criteria for hand OA, n (%) (n=77)</th>
<th>Body mass index, mean (SD) (n=71)</th>
<th>Follow-up time, mean (SD) years</th>
<th>Symptom duration, mean (SD) years (n=68)</th>
<th>AUSCAN pain, mean (SD) (0–20 scale) (n=76)</th>
<th>AUSCAN physical function, mean (SD) (0–36 scale) (n=75)</th>
<th>Handedness, n (%) dominant right hand (n=72)</th>
<th>Grip strength dominant hand, mean (SD) (n=69)</th>
<th>Ultrasonographic findings (joint level)</th>
<th>Osteophytes, n (%)</th>
<th>Synovitis, n (%)</th>
<th>Power Doppler, n (%)</th>
<th>Radiographic findings (joint level)</th>
<th>KLG grade ≥ 2, n (%)</th>
<th>Osteophytes, n (%)</th>
<th>JSN, n (%)</th>
<th>Erosions, n (%)</th>
<th>Clinical examination (joint level)</th>
<th>Swollen joints, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, n (%) female</td>
<td>71 (91.0%)</td>
<td>Age, mean (SD) years</td>
<td>67.8 (5.2)</td>
<td>Fulfilling ACR criteria for hand OA, n (%) (n=77)</td>
<td>71 (92.2%)</td>
<td>Body mass index, mean (SD) (n=71)</td>
<td>25.4 (3.7)</td>
<td>Follow-up time, mean (SD) years</td>
<td>4.7 (0.4)</td>
<td>Symptom duration, mean (SD) years (n=68)</td>
<td>18.5 (7.9)</td>
<td>AUSCAN pain, mean (SD) (0–20 scale) (n=76)</td>
<td>8.2 (3.9)</td>
<td>AUSCAN physical function, mean (SD) (0–36 scale) (n=75)</td>
<td>15.3 (7.8)</td>
<td>Handedness, n (%) dominant right hand (n=72)</td>
<td>70 (97.2)</td>
<td>Grip strength dominant hand, mean (SD) (n=69)</td>
<td>20.3 (7.8)</td>
<td>Ultrasonographic findings (joint level)</td>
<td>Osteophytes, n (%)</td>
</tr>
</tbody>
</table>

AUSCAN, Australian/Canadian hand index; JSN, joint space narrowing; KLG, Kellgren–Lawrence grade.
All participants had radiographic hand OA (one or more joints with KL grade ≥2), and 71 (91.0%) fulfilled the clinical American College of Rheumatology criteria for hand OA.11

At baseline, 73 (93.6%) and 33 (42.3%) patients had GS synovitis and PD present in one or more joints, respectively. In joints with definite radiographic OA (ie, KL grade ≥2) at baseline, GS synovitis was present in 309 of 1078 joints (28.7%), of which 50 joints (16.2%) presented PD signals. Synovitis was most commonly mild (grade 1; 16.3%) and moderate (grade 2; 9.2%).

Radiographic erosive disease was present in 46 patients (59.0%), of whom 43 were women. Patients with radiographic erosive disease had more severe radiographic joint damage than those without erosive disease (p<0.001 for all radiographic features). Erosions only occurred in joints with KL grades 3–4 and JSN grades 2–3. Among joints with KL grades 3 and 4, GS synovitis was more common in non-erosive (39.4%) than erosive joints (29.0%), p=0.01.

Radiographic progression

The number of joints with radiographic progression after 5 years is shown in online supplementary table S1. For all radiographic features, the majority had an increase of only one grade, and progression was most common in joints with mild disease.

At baseline, 232 joints (10.2%) had KL grade=4, 210 (9.2%) had JSN grade=3, 114 (5.0%) had osteophyte grade=3 and 256 joints (11.3%) had erosions. These joints were omitted in the longitudinal GEE analyses due to no potential for progression. In the remaining joints, progression of KL grade was found in 17.9% of the joints, while JSN, osteophytes and erosions developed or progressed in 12.1%, 11.7% and 4.5% joints, respectively.

Ultrasound inflammation as a predictor for progression of radiographic hand OA

In the adjusted analysis, KL progression after 5 years was strongly predicted by the presence of ultrasound-detected GS synovitis (OR=3.3, 95% CI 2.4 to 4.6) and PD signals (OR=5.0, 95% CI 2.6 to 9.4) at baseline compared with joints without ultrasound inflammation (figure 1). GS and PD were also significant predictors for all measures of individual radiographic features: GS synovitis was associated with erosive development (OR=6.0, 95% CI 3.6 to 10.2), JSN progression (OR=4.0, 95% CI 2.9 to 5.6) and radiographic osteophyte progression (OR=3.8, 95% CI 2.7 to 5.4), whereas PD signals most strongly predicted osteophyte progression (OR=7.6, 95% CI 4.5 to 12.6), then erosive development (OR=7.0, 95% CI 2.8 to 17.8, p=0.003) and JSN (OR=5.2, 95% CI 2.7 to 10.1). All analyses presented p≤0.01 if not stated otherwise.

A dose–response association was observed (table 2) as joints with severe GS synovitis (grade 3) at baseline had 2–3 times higher risk of radiographic progression than joints with moderate synovitis (grade 2), and similarly for moderate versus mild synovitis. Merging moderate and severe PD signals (grades 2 and 3) into one score, a similar dose–response association was seen between levels of PD signals and progression of radiographic KL grade, osteophytes and JSN (table 3). With an additional adjustment for KL grade, both GS and PD remained significant and dose–responsive predictors for all radiographic features except for erosive development in joints with PD signals grades 2–3 (however, there were few actual joints, which limits the impact (n=19), p=0.33).

When dividing patients into four equally sized groups (four quartiles) according to increased general hand OA loading (ie, sum of KL grade), we found baseline GS synovitis to be a weaker predictor for KL progression in patients with lowest OA loading (first quartile OR=1.9, 95% CI 1.0 to 3.4), but a strong predictor in the remaining patients with higher loading: second quartile OR=3.0 (95% CI 1.4 to 6.4), third quartile OR=4.3 (2.6 to 7.2) and fourth quartile OR=3.2 (95% CI 1.7 to 6.3). GS synovitis appeared to be an equal risk factor for progression

Figure 1 Ultrasound examination of a fourth right finger at baseline (February 2009) and corresponding conventional radiographs taken at baseline and follow-up (September 2013). The proximal interphalangeal joint (PIP) joint demonstrated extensive synovial inflammation (synovitis and power Doppler signals) at baseline, and severe radiographic osteoarthritis progression (*) 4.7 years later: Kellgren–Lawrence grade progressed from 1 to 4, with more joint space narrowing, osteophytes and sclerosis. The metacarpophalangeal joint (MCP) and distal interphalangeal joint (DIP) joints were normal.

Clinical and epidemiological research

Table 2  Baseline ultrasonographic gray-scale (GS) synovitis as predictor for radiographic progression in the same joint after 4.7 years of follow-up of patients with hand osteoarthritis

<table>
<thead>
<tr>
<th>Baseline ultrasound</th>
<th>Radiographic progression, n (%)</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)*†</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS synovitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 0 (n=1715)</td>
<td>246 (14.3)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Grade 1 (n=185)</td>
<td>59 (31.9)</td>
<td>2.7 (1.8 to 4.0)</td>
<td>2.8 (1.8 to 4.2)</td>
</tr>
<tr>
<td>Grade 2 (n=111)</td>
<td>42 (37.8)</td>
<td>3.5 (2.3 to 5.4)</td>
<td>3.6 (2.2 to 5.8)</td>
</tr>
<tr>
<td>Grade 3 (n=22)</td>
<td>15 (68.2)</td>
<td>11.4 (5.7 to 22.6)</td>
<td>15.2 (6.9 to 33.6)</td>
</tr>
</tbody>
</table>

Osteophytes

Grade 0 (n=1804) 154 (8.5) 1.0 1.0
Grade 1 (n=198) 39 (19.7) 2.5 (1.7 to 3.8) 2.5 (1.6 to 3.9)
Grade 2 (n=121) 44 (36.4) 5.9 (3.8 to 9.1) 5.6 (3.4 to 9.2)
Grade 3 (n=25) 14 (56.0) 13.4 (7.1 to 25.1) 11.0 (5.1 to 23.6)

Joint space narrowing

Grade 0 (n=1732) 155 (8.9) 1.0 1.0
Grade 1 (n=186) 51 (27.4) 3.7 (2.3 to 5.9) 3.5 (2.1 to 5.8)
Grade 2 (n=114) 31 (27.2) 3.7 (2.5 to 5.3) 3.9 (2.6 to 5.7)
Grade 3 (n=22) 12 (54.5) 11.0 (4.6 to 26.4) 17.0 (6.8 to 43.0)

Erosions

Grade 0 (n=1704) 47 (2.8) 1.0 1.0
Grade 1 (n=180) 18 (10.0) 3.7 (1.9 to 6.9) 3.9 (1.9 to 7.8)
Grade 2 (n=106) 19 (11.9) 6.8 (3.3 to 14.1) 9.1 (4.2 to 19.4)
Grade 3 (n=17) 6 (35.3) 16.1 (6.4 to 40.9) 15.7 (6.8 to 36.2)

Generalised estimating equations presented as ORs for radiographic progression with separate models for each radiographic feature.

*Number and percentage progressive joints among those with different grades of GS synovitis.
†Adjusted for age, sex, body mass index, follow-up time and other radiographic erosive joints at baseline.

Table 3  Baseline ultrasonographic power Doppler (PD) signals as predictor for radiographic progression in the same joint after 4.7 years of follow-up of patients with hand osteoarthritis

<table>
<thead>
<tr>
<th>Baseline ultrasound</th>
<th>Radiographic progression, n (%)</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)*†</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD signals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 0 (n=1998)</td>
<td>340 (17.0)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Grade 1 (n=27)</td>
<td>12 (44.4)</td>
<td>3.7 (1.8 to 7.7)</td>
<td>2.9 (1.2 to 6.8)</td>
</tr>
<tr>
<td>Grade 2–3 (n=18)</td>
<td>13 (72.2)</td>
<td>11.6 (4.1 to 33.1)</td>
<td>12.0 (3.5 to 41.0)</td>
</tr>
</tbody>
</table>

Osteophytes

Grade 0 (n=2109) 226 (10.7) 1.0 1.0
Grade 1 (n=31) 14 (45.2) 6.4 (3.3 to 12.1) 5.6 (2.7 to 11.7)
Grade 2–3 (n=20) 13 (65.0) 15.6 (7.5 to 32.4) 11.8 (5.6 to 25.2)

Joint space narrowing

Grade 0 (n=2020) 232 (11.5) 1.0 1.0
Grade 1 (n=26) 9 (34.6) 3.9 (2.0 to 7.6) 3.8 (1.8 to 8.1)
Grade 2–3 (n=19) 9 (47.4) 6.4 (2.2 to 18.3) 7.8 (2.4 to 25.8)

Erosions

Grade 0 (n=1972) 80 (4.1) 1.0 1.0
Grade 1 (n=28) 7 (25.0) 7.1 (2.6 to 19.1) 9.4 (2.6 to 33.3)
Grade 2–3 (n=19) 3 (15.8) 3.8 (1.1 to 13.4) 4.4 (1.4 to 14.1)

Generalised estimating equations presented as ORs for radiographic progression with separate models for each radiographic feature.

*Number and percentage progressive joints among those with different grades of PD signals.
†Adjusted for age, sex, body mass index, follow-up time and other radiographic erosive joints at baseline.

Table 4  Clinical soft tissue swelling as baseline predictor for radiographic progression in the same joint after 4.7 years of follow-up of patients with hand osteoarthritis

<table>
<thead>
<tr>
<th>Radiographic progression, n (%)</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)*†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft tissue swelling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent (n=1647)</td>
<td>242 (14.7)</td>
<td>1.0</td>
</tr>
<tr>
<td>Present (n=393)</td>
<td>123 (31.3)</td>
<td>2.5 (1.8 to 3.4)</td>
</tr>
<tr>
<td>Absent (n=1692)</td>
<td>149 (8.8)</td>
<td>1.0</td>
</tr>
<tr>
<td>Present (n=465)</td>
<td>104 (22.4)</td>
<td>2.7 (1.9 to 3.9)</td>
</tr>
<tr>
<td>Absent (n=1655)</td>
<td>151 (9.1)</td>
<td>1.0</td>
</tr>
<tr>
<td>Present (n=407)</td>
<td>98 (24.1)</td>
<td>3.2 (2.2 to 4.6)</td>
</tr>
<tr>
<td>Absent (n=1636)</td>
<td>44 (2.7)</td>
<td>1.0</td>
</tr>
<tr>
<td>Present (n=379)</td>
<td>46 (12.1)</td>
<td>4.8 (3.3 to 7.1)</td>
</tr>
</tbody>
</table>

Generalised estimating equations presented as ORs for radiographic progression with separate models for each radiographic feature.

*Percentage progressive joints among those with different grades of gray-scale synovitis.
†Adjusted for age, sex, body mass index, follow-up time and other radiographic erosive joints at baseline.

of KL grade in joints with baseline KL grade ≤1 (OR=2.9) and joints with baseline KL grade ≥2 (OR=2.9).

Clinical soft tissue swelling as predictor for progression of radiographic hand OA

Presence of soft tissue swelling by clinical examination also predicted radiographic progression of hand OA (table 4). The strongest association was observed for progression of erosions (OR=5.3, 95% CI 3.6 to 7.8) and JSN (OR=3.0, 95% CI 2.0 to 4.5).

DISCUSSION

This longitudinal study of patients with hand OA demonstrated that ultrasound findings reflecting inflammation could predict future radiographic progression on a joint level. We found a strong and dose–response association between presence of ultrasound-detected inflammatory features at baseline and radiographic progression in the same joint after 4.7 years. These findings support that inflammation is involved in the pathogenesis of hand OA and indicate the use of ultrasound as a tool to detect patients with hand OA who are likely to progress.

OA joints with inflammation had a significantly higher risk of progression than OA joints without inflammation (tables 2 and 3). Kortekaas et al25 presented similar findings in a recent hand OA study on 56 patients, where osteophytes and JSN progression often were preceded by PD activity and synovitis. However, our ultrasound study is the first to demonstrate that even small amounts of synovitis (grade 1) significantly increase the risk of future radiographic progression in the same finger joint, and the associations were substantial for all radiographic features. Our study is also the first to show a definite dose–response correlation between baseline inflammation and radiographic progression. Furthermore, our analyses suggest that patients with higher overall degree of OA are more influenced by synovitis on radiographic progression, but the effect of synovitis was equal in joints with and without baseline radiographic OA.

Synovial inflammation occurs in both early and late phases of OA,9 11 32 and is directly linked to clinical symptoms such as joint swelling and pain.17–20 Catabolic and proinflammatory
mediators are produced in the inflamed synovium and alter the balance of cartilage matrix degradation and repair, leading to excess production of the proteolytic enzymes responsible for cartilage breakdown. Cartilage alteration in turn increases synovial inflammation, thus creating a vicious circle.

More evidence from studies on knee OA suggests that synovitis has an important role in structural degradation of the OA joint. With arthroscopy, Ayral et al observed more joint damage after 1 year when the medial perimeniscal synovium had ‘inflammatory’ appearance at baseline, OR=3.11 (1.07 to 5.69). An MRI study of 347 knees with minimal baseline cartilage damage demonstrated that synovitis and effusion was associated with an increased risk of rapid cartilage loss, OR=3.36 (0.91 to 12.4).

In a large, multicentre European League Against Rheumatism prospective study on >500 subjects with knee OA, presence of baseline joint effusion by ultrasound was a significant predictor of joint replacement at 3 years (HR=2.63). Inflammatory ultrasound features were seen in nearly all our patients. The present analyses were performed on data collected at two follow-up examinations, in which patients did not seek medical care, and thus with random disease activity. Still, 3 out of 10 OA joints had GS synovitis, whereas PD activity was much less common. Our cohort was older and had longer disease duration than patients in similar ultrasound studies of hand OA, and may explain the low prevalence of PD activity.

In the present study, soft tissue swelling identified through clinical examination was also shown to be a significant predictor for radiographic progression (table 4). Even if clinical evaluations may not be highly reliable, it is of clinical interest that swollen joints were associated with development of structural damage, and thus reflects a possible predicting ability of an experienced clinician. We found, however, that ultrasound inflammation was an even stronger predictor for radiographic progression than soft tissue swelling, especially in the presence of PD activity.

There are some limitations to our study. First, the radiographs were read with known time sequence, that is, the reader knew the order of the radiographs that may lead to an overestimation of radiographic progression. However, serial images in risk factor studies are recommended to usually be read in known chronology in order to improve sensitivity to change. Second, the current available ultrasound atlas on inflammation is based on patients with RA and not hand OA. In contrast to RA, the synovial inflammation in knee OA is usually patchier distributed and confined to areas adjacent to sites of chondropathy. Whether the scoring is transferable remains to be explored. Third, a reliability exercise of the clinical examination of soft tissue swelling was not performed. The strengths of our study are the long follow-up time, the large number of joints examined and the good reliability for the sonographic and radiographic readings.

In conclusion, this study confirmed with ultrasound that both GS synovitis and PD activity are risk factors for radiographic progression in hand OA. The predictive association was strong and coherent for all radiographic features. Thus, by detecting inflammation, ultrasound could prove beneficial in predicting future radiographic progression and be used in prospective medical trials of hand OA. However, whether drugs targeted at synovitis can slow or even prevent disease progression in hand OA needs to be explored in future studies.

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Contributors AM: study design, data collection, analysis and interpretation of data, drafting the article and final approval. TKK: study design, critical revision of the article and final approval. BS-C, HBH and IKH: study design, data collection, critical revision of the article and final approval.

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REFERENCES


Clinical and epidemiological research


Ultrasound-detected inflammation predicts radiographic progression in hand osteoarthritis after 5 years

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