SYMMETRIC PREVALENCE OF CARTILAGE DAMAGE, BONE MARROW LESIONS AND MENISCAL LESIONS IN SUBJECTS WITH KNEE PAIN: THE JOG STUDY

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BACKGROUND

– Several risk factors have been associated with incident radiographic OA, on a local (joint) or systemic (person) level [1,2]

– MRI is capable of visualizing tissue pathology at a pre-radiographic stage

– Studies on bilaterality of OA-associated tissue damage is sparse

– One study described a symmetrical pattern for hand OA based on radiography but no studies assessed bilaterality of MRI based OA-features on the knee joint [3]

[1]Zhang Y, Jordan JM. Rheum Dis Clin North Am 2008;34:515–29
[2]Felson DT, et al. Ann Intern Med 2000;133:635–46
[3] Niu J, et al. Rheumatology 2003;42:343–348

AIM

Study aim was to describe symmetricity of MRI-detected OA features in a cohort with or without radiographic OA and knee pain

METHODS

- **Subjects**

  169 subjects aged 35-65 with chronic, frequent knee pain (WOMAC score ≥125 and ≤500) were recruited (Joints on Glucosamine Study Cohort) - a total of 346 knees were included

- **MRI acquisition**

  3T MRI (Siemens Trio, Erlangen, Germany) of each knee was performed at baseline using the same sequence protocol as in the OAI (sag IW fs, cor IW, triplanar DESS)
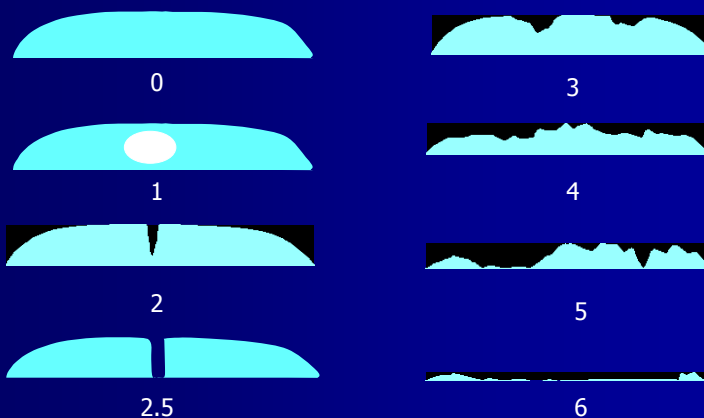
METHODS

- **MRI interpretation**

  - Knees were semiquantitatively assessed according to the WORMS system by one expert MSK radiologist

  - Knees read in random order (l/r)

  - Cartilage damage (from 0-6) and bone marrow lesions (BMLs – from 0-3) were read in 14 subregions

  - Meniscal damage was read in three medial and three lateral subregions (from 0-4)

METHODS: WORMS subregions
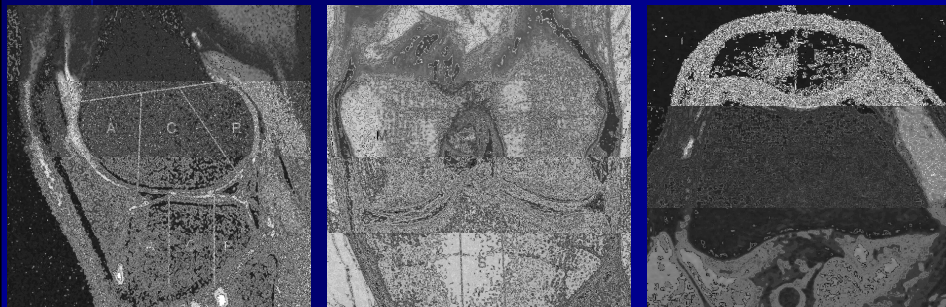
METHODS: WORMS cartilage scoring

0	3
1	4
2	5
2.5	6

Extent and depth of articular surface lesion per subregion scored (± intrachondral signal)

METHODS: Analytic approach

– Chi^2 tests were used to compare the proportion of people with unilateral tissue pathology to the proportion that would be expected if the two knees of an individual were unrelated to each other

– For this analysis, all MRI features were divided into present (score≥1) and absent (score=0)

METHODS: Analytic approach

- Linear weighted (w) kappa statistics to describe agreement between knees for cartilage damage and BMLs in the same articular plates using the full WORMS scores (0-4 for cartilage and 0-3 for BML)

- Non-weighted kappa statistics were used to assess agreement between articular subregions

RESULTS

- **Baseline demographic characteristics of the subjects**

  - Mean age: 52.1 (SD, ±6.2) years

  - 95 (53.7%) were men, 160 (90.4%) were white

  - Mean BMI: 29.1 (SD ±4.1) kg/m^2

  - Worst Kellgren/Lawrence (KL) grades in either knee were: K/L 0: 37 (21.9%) knees, K/L 1: 14 (8.3%) knees, K/L 2: 26 (15.4%) knees, K/L 3: 78 (46.2%) knees K/L 4: 14 (8.3)

RESULTS: Cartilage and BMLs per plate

Plate (Worst grade in plate)	Exact % agreement	Expected % agreement	Weighted kappa	Standard Error
Cartilage				
Patella	88.99%	73.00%	0.59	0.054
Femoral Trochlea	91.12%	80.73%	0.54	0.058
Medial Femur	86.09%	79.55%	0.32	0.055
Lateral Femur	89.94%	85.28%	0.32	0.069
Medial Tibia	86.39%	79.27%	0.34	0.057
Lateral Tibia	90.53%	85.25%	0.36	0.059
BMLs				
Patella	82.64%	70.64%	0.41	0.058
Femoral Trochlea	83.63%	75.11%	0.34	0.059
Medial Femur	86.39%	81.54%	0.27	0.060
Lateral Femur	94.67%	93.08%	0.23	0.060
Medial Tibia	87.50%	83.55%	0.24	0.061
Lateral Tibia	90.53%	89.80%	0.07	0.061

RESULTS: Cartilage and BMLs per subregion

Subregions ranked in descending order of kappa value (4 highest shown)	Exact % agreement	Expected % agreement	Non-weighted kappa	Standard Error
Cartilage				
1. Lateral patella	84.52%	51.70%	0.68	0.077
2. Lateral femur anterior	84.02%	61.63%	0.58	0.076
3. Medial tibia central	82.25%	62.05%	0.53	0.077
4. Medial patella	77.38%	52.56%	0.52	0.077
BMLs				
1. Lateral femur posterior	96.45%	92.05%	0.55	0.076
2. Lateral patella	74.56%	58.99%	0.38	0.077
3. Medial femur central	79.29%	70.21%	0.30	0.075
4. Lateral femur anterior	78.11%	68.89%	0.30	0.077

RESULTS: Meniscus

Meniscal Subregion	Exact % agreement	Expected % agreement	Non-weighted kappa	Standard Error
Anterior medial	98.22	94.81	0.66	0.076
Body medial	84.02	62.93	0.57	0.077
Posterior Medial	79.88	56.45	0.54	0.077
Anterior lateral	94.08	93.12	0.14	0.072
Body lateral	87.57	86.26	0.10	0.075
Posterior lateral	91.12	87.23	0.31	0.073

LIMITATIONS

- JOG not an OA study but focusing on knee pain also including subjects without OA

- No gold standard of e.g. arthroscopy for cartilage and meniscal lesions

- Associations with (possible symmetricity of) symptoms not analyzed

EXAMPLES: focal FT cartilage defect
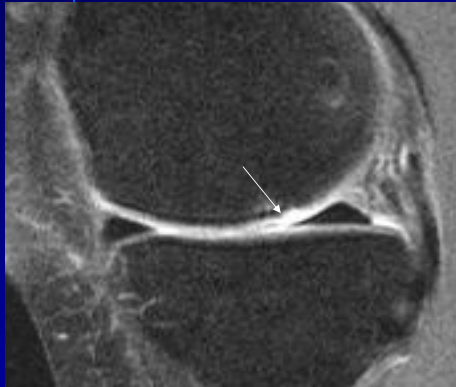
RIGHT KNEE

LEFT KNEE

Medial TF compartment
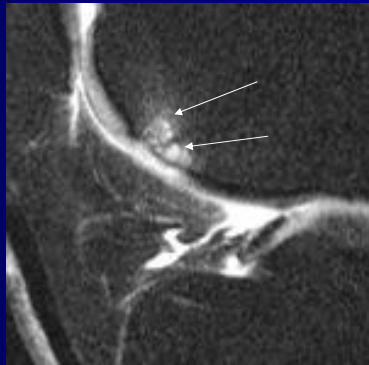

EXAMPLES: Horizontal Meniscal Tear
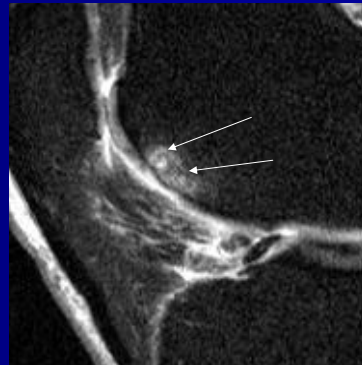
RIGHT KNEE

LEFT KNEE

Medial TF compartment
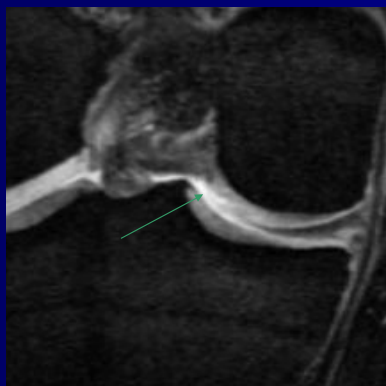
EXAMPLES: Trochlea bone marrow lesion

RIGHT KNEE LEFT KNEE

Lateral PF compartment

EXAMPLES: Superficial focal cartilage defect

RIGHT KNEE LEFT KNEE

Medial TF compartment

CONCLUSIONS

- A higher degree of symmetricity of articular tissue damage than expected by chance was observed in this cohort of subjects with knee pain

- These findings support the hypothesis that OA is a multifactorial disease triggered by risk factors on an individual joint level, but also by person-based risk factors

- These risk factors seem to predispose joints not only to radiographic OA but also to articular tissue damage commonly associated with OA

DISCLOSURES

- The Joints on the Glucosamine Study was supported by the research grant from the Coca-Cola Company Beverage Institute for Health & Wellness

- Ali Guermazi is President of Boston Imaging Core Lab (BICL) LLC. He is a consultant to AstraZeneca, MerckSerono, Genzyme, Novartis, and Stryker

- Frank W Roemer is CMO of BICL and is a consultant to MerckSerono and National Institutes of Health

- Kent Kwoh is a consultant to Novartis

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