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More or less imaging in axial SpA? ——

OP0114   **LOW DOSE COMPUTED TOMOGRAPHY DETECTS MORE PROGRESSION OF BONE FORMATION IN COMPARISON TO CONVENTIONAL RADIOGRAPHY IN PATIENTS WITH ANKYLOSING SPONDYLITIS: RESULTS FROM THE SIAS COHORT**

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Background: Recently we presented the good interreader reliability and sensitivity to detect changes with a newly developed scoring method of bone formation on low dose computed tomography (LD-CT) of the whole spine in patients (pts) with Ankylosing Spondylitis (AS)[1]. Next step in the validation is the comparison with conventional radiographs (CR).
Objectives: To compare the assessment of syndesmophyte formation and growth on CR and LD-CT in pts with AS.
Methods: Pts from the SIAS (Sensitive Imaging of Axial Spondyloarthritis) cohort from Leiden and Herne were analysed. Inclusion criteria were modified NY criteria, ≥1 syndesmophytes on either the cervical and/or lumbar spine on CR, and ≥1 inflammatory lesion on MRI-spine. Pts had CR of the lateral cervical and lumbar spine and LD-CT (approximately 2–3mSV) of the entire spine at baseline and two years. Two readers independently assessed both CR and CT in separate sessions. Images were paired per patient, blinded to time order, patient information, and result of the other imaging technique. CR was assessed using the mSASSS scoring method. On CT, syndesmophytes were scored in the coronal and sagittal planes for all "corners" per view, thus scoring 8 "corners" per vertebral unit. Syndesmophytes were scored as absent (score 0), <50% of the intervertebral disc height (IVDH) (score 1), $\geq50\%$ of the IVDH but no bridging (score 2) or as bridging the IVDH (score 3)[1]. The formation of new syndesmophytes (CR score 0 or 1→2 or 3, CT 0→1 or 2 or 3) and growth of existing syndesmophytes (CR score 2→3, CT 1→2 or 3, or 2→3) and the combination of both was calculated per vertebral corner. Consensus about each of these outcomes was defined by agreement of both readers on the same vertebral level. Data of CR and CT was compared per reader and for the consensus score.
Results: 50 patients (mean age 48.6 years; 84% male; 80% HLA-B27) were included in the analysis. The number (%) of pts with newly formed, growth or combined newly formed and growth of syndesmophytes for separate readers and consensus score are presented in table 1. In all comparisons, CT detected more patients with progression. This is especially apparent in case of growth and for cut-offs of a higher number of (newly formed or growth of) syndesmophytes per patient. E.g. with the strictest comparison of the consensus score for both CR and CT, 30% of the patients show bony proliferation (newly formed and growth) at ≥3 sites on CT compared with only 6% on CR.

Table 1. Comparison of CR and CT per reader and consensus* for the formation and/or growth of syndesmophytes in 50 patients with ankylosing spondylitis.

New syndesmophytes	Reader 1		Reader 2		Consensus	
	CR	CT	CR	CT	CR	CT
≥1	27 (54)	43 (86)	30 (60)	44 (88)	19 (38)	21 (42)
≥2	14 (28)	38 (76)	14 (28)	41 (82)	7 (14)	15 (30)
≥3	6 (12)	32 (64)	8 (16)	30 (60)	2 (4)	10 (20)
Growth of syndesmophytes						
≥1	10 (20)	35 (70)	7 (14)	32 (64)	3 (6)	16 (32)
≥2	8 (16)	36 (52)	6 (12)	27 (54)	3 (6)	11 (22)
≥3	2 (4)	23 (46)	4 (8)	18 (36)	1 (2)	6 (12)
New syndesmophytes or growth of syndesmophytes						
≥1	28 (56)	45 (90)	33 (66)	48 (96)	21 (42)	25 (50)
≥2	18 (36)	42 (82)	19 (38)	44 (88)	9 (18)	20 (40)
≥3	12 (24)	36 (72)	12 (24)	38 (76)	3 (6)	15 (30)

Results are presented as the number (%) of patients with ≥1, ≥2 and ≥3 newly formed syndesmophytes and syndesmophytes that grew, as well as for the combination of new formation and growth.
*Both readers agree about the formation or growth of a syndesmophyte at the same vertebral corner.
CR: conventional radiography, CT: computed tomography

Conclusions: LD-CT covering the whole spine, is a more sensitive method for assessing the formation and growth of syndesmophytes than CR which is limited to cervical and lumbar spine in pts with AS and is a promising method of assessment for clinical research.
References:
[1] de Bruin F et al. A&R 2016; 68 (suppl 10).

OP0115   **EVALUATION OF THE CHANGES IN STRUCTURAL DAMAGE IN AXIAL SPONDYLOARTHRITIS ON PLAIN PELVIC RADIOGRAPHS: THE 5 YEARS DATA OF THE DESIR COHORT**

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Background: The structural damage of axial spondyloarthritis can be evaluated either at the spine or at the Sacroiliac Joint (SIJ) level and by using either plain X-Rays or MRI. So far, the evaluation of the changes in structural damage at the SIJ level has referred mainly to plain X-Rays and to a binary variable (e.g. fulfillment of the modified New York (mNY) criteria yes/no).
Objectives: To evaluate the reliability and the sensitivity to change of different outcome measures of SIJ structural damage observed at pelvic X-Rays.
**Methods:** *Study design:* Prospective longitudinal (5 years) follow-up of patients with recent onset (≤3 years) axial SpA (according to the treating rheumatologist) enrolled in the DESIR cohort. *Data collected:* Pelvic X-Rays at baseline and after 2 and 5 years of follow-up. *Reading procedure:* The films were evaluated by 3 trained readers unaware of their chronology according to the 0–4 mNY grading scale (from 0 = normal to 4 = fusion) for each SIJ (left and right). *Outcome measures:* One continuous variable: change in the total score (from 0 to 8) and 3 dichotomous variables: A/ Switch from non-radiographic (nr) to radiographic (r) axial SpA according to the mNY definition (e.g. at least unilateral grade III or bilateral grade II), B/ Change of at least one grade in at least one SIJ C/ Change of at least one grade in at least one SIJ and an absolute final value of the worsened joint of at least 2. *Statistical analysis:* a) inter-reader reliability of the changes in the outcome measures (intra-class correlation coefficient for the continuous outcome and Kappa statistics for the dichotomous outcomes) b) sensitivity to change by evaluating the % of net progressors (e.g. worsened minus improved) on both the completer population and the patients with at least one post baseline radiological evaluation using different missing data handling technics (Last Observation Carried Forward, Linear Extrapolation).
Results: The number of patients with available readings from all 3 readers were: 416 (baseline and 5 years), 378 (all time points) and 557 (baseline and at least one post baseline). The results were similar whatever the technic of data missing handling.
In the completer population, (a) The inter-reader reliability was low to modest: 0.21 (0.15–0.28) for the continuous variable and 0.23 (0.10–0.41), 0.24 (0.16–0.34) and 0.23 (0.13–0.35) for the dichotomous variables A, B and C, respectively.
(b) The changes in the total continuous score (from 1.41±1.68 to 1.60±1.83) was modest but highly significant (e.g. 0. 19±0.55 p<0.0001). The percentage of net progressors are summarized in the figure. These were 5.1%, 13.6% and 10.2% for the dichotomus variables A, B and C respectively.

Fig: changes in different binary SIJ-Plain X-Rays outcome measures
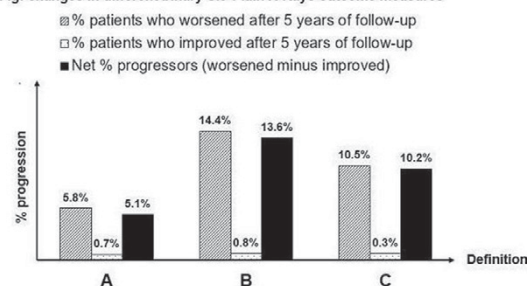
A = Switch from nr to r-axSpA according to the mNY criteria (worsened) *minus* switch from r to nr-axSpA
B = Change in at least one grade in at least one SIJ
C = Change in at least one grade in at least one SIJ and a final (at year 5) absolute value of at least 2 in the worsened joint (worsened) *minus* change in at least one grade in at least 1 SIJ and a baseline (year 0) absolute value of at least 2 in the improved joint

Conclusions: These data suggest that the structural progression at the SIJ level in recent onset SpA does exist but is modest. Different definitions of changes (e.g. at least one grade in at least one SIJ) seem to be more sensitive than the conventional definition (e.g. switch from nr to r) while reliability was similar. Therefore, these definitions might be useful to evaluate the natural history of the disease.

OP0116   **SWITCH FROM NON-RADIOGRAPHIC TO RADIOGRAPHIC AXIAL SPONDYLOARTHRITIS IS HIGHLY DEPENDENT OF BASELINE OBJECTIVE SIGNS OF INFLAMMATION: 5 YEAR DATA OF THE DESIR COHORT**

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Background: The natural history (e.g. appearance of structural damage) of non-radiographic (nr) axial (ax) Spondyloarthritis (SpA) is not well known.
Objectives: To evaluate the switch from nr- to radiographic (r) status of recent onset axSpA after 5 years of follow-up and its predisposing factors.
Methods: *Patients:* Recent onset axial SpA (DESIR Cohort). *Outcome measure:* Radiographic SIJ status according to the mNY criteria after 5 years follow-up. *Reading of the SIJ-X-Rays:* 3 trained readers unaware of the chronology of the films. *Potential predisposing factors:* Demographics, smoking status, HLA-B27, Bone Marrow Edema (BME) at MRI of the SIJ, CRP, disease activity and

treatment. *Statistical analysis:* The radiographic progression has been evaluated in both the completers and after Linear Extrapolation (LE) and Last Observation Carried Forward (LOCF) technique in case of missing data. The predictive factors of radiographic progression were evaluated on the completer population using multilevel binomial GEE analysis incorporating measurements from all readers at 5-years and taking into account the within-reader correlation.Moreover, the progression rate was assessed in subgroups of patients according to CRP status and MRI-SIJ status at baseline.

Results: At baseline, 62 out of the 416 patients (14.9%) were considered r-ax-SpA. Out of these 416 patients, 24 (5.8%) changed from mNY negative to mNY positive after 5-years. Conversely, 3 patients changed from mNY positive at baseline to negative at year 5 (e.g. 0.7%) resulting in a net progression of 5.1%. These results were similar when applying LOCF and LE (4.1% and 3.8% net progression).

In the multivariate analysis, presence of BME at MRI-SIJ was highly predictive of radiographic progression (OR=4.85 [95% CI: 2.95–7.97]) together with a younger age (OR=0.97 [95% CI: 0.94–0.99]) and longer symptom duration (OR=1.40 [95% CI: 1.04–1.89]).

Of the 383 patients with complete data, the net % patients who switched from nr-axSpA to r-axSpA after 5 years ranged from 2.0% to 13.5% according to the presence of objective signs of inflammation at baseline (see figure).

Fig: Net % patients who switched from nr to r-axSpA after 5 years of follow-up

*% patients who switched from nr to r-axSpA *minus* % patients who switched from r to nr-axSpA according to the mNY criteria
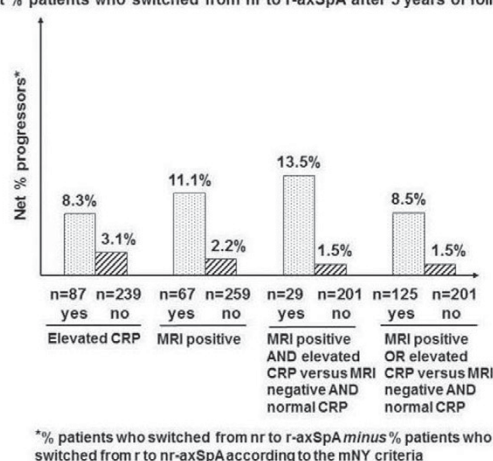
Conclusions: This is the first cohort in early axSpA with 5-year follow-up demonstrating the importance of presence of objective signs of inflammation as predisposing factors of development of radiographic sacroiliitis.

Disclosure of Interest: None declared

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OP0117   **BONE MARROW OEDEMA IN SACROILIAC JOINTS OF YOUNG ATHLETES SHOWS MOST FREQUENTLY IN THE POSTERIOR INFERIOR ILIUM**

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Background: Low grade bone marrow oedema (BMO) was reported in the sacroiliac joints (SIJ) of up to 25% of healthy individuals and mechanical back pain patients, challenging the imaging discrimination from early spondyloarthritis (SpA) [1]. Potential explanations range from mechanical stress lesions to vascular signals and anatomical SIJ variants.

Objectives: To determine BMO frequency and anatomical distribution in 8 SIJ regions in hobby and professional athletes.

Methods: The sample consisted of 2 cohorts of 20 healthy hobby runners (HR) before and after running and 22 professional ice hockey players (IP) from the Danish premier league: HR/IP 40%/100% men; mean age (SD) 27.2 (5.4)/25.9 (4.6) years; mean BMI (SD) 22.6 (1.5)/25.7 (1.6) kg/m². Semicoronal MRI scans of the SIJ with T1SE and STIR sequences were obtained in HR before and 24 hours after a running competition over 6.2 kilometers (mean duration 35.4 minutes, mean speed 10.4 km/h), and in IP during the competitive season. The scans were assessed for BMO independently by 3 blinded readers (AGJ, AZ, UW) according to the quadrant based MORPHO module (www.carearthritis.com). Paired images of HR were read blinded to timepoint. 7 MRI scans (2 paired images) of SpA patients under TNF treatment served to mask readers. A pre-test reader calibration used MRI scans from 11 patients with active sacroiliitis and 9 healthy volunteers. Reader agreement was assessed by ICC (3, 1). Descriptive analysis comprised mean frequency of SIJ quadrants with BMO and distribution of BMO quadrants in 8 anatomical SIJ regions: upper/lower ilium and sacrum, subdivided in anterior and posterior slices, as concordantly recorded by the majority (≥2/3) of readers.

Results: Agreement among 3 readers for SIJ BMO was excellent in calibration (ICC 0.93) and moderate in athletes (ICC 0.59) due to low frequency of BMO. The mean number (SD) of SIJ quadrants showing BMO was 3.1 (4.2)/3.1 (4.5) in HR before/after running, and 3.6 (3.0) in IP. The posterior inferior ilium was the single most affected region, followed by the upper anterior sacrum, consistently across 2 cohorts of athletes.

Table 1. Frequency and anatomical distribution of SIJ quadrants with BMO in 2 cohorts of athletes

Cohort	SIJ quadrants	Upper Ilium		Lower Ilium		Upper Sacrum		Lower Sacrum	
		Anterior	Posterior	Anterior	Posterior	Anterior	Posterior	Anterior	Posterior
HR before									
	Mean (SD)	0.1 (0.4)	0.1 (0.3)	0.2 (0.7)	1.4 (1.9)	0.5 (0.9)	0.1 (0.4)	0.3 (0.6)	0.5 (1.6)
	≥1 Q (n)	3	0	1	8	4	2	3	1
	≥2 Q (n)	0	0	1	6	3	0	0	1
	≥3 Q (n)	0	0	1	2	1	0	0	1
	≥4 Q (n)	0	0	0	1	0	0	0	1
HR after									
	Mean (SD)	0.2 (0.4)	0 (0.1)	0.3 (0.8)	1.2 (1.7)	0.5 (1.0)	0.2 (0.7)	0.3 (0.7)	0.5 (1.6)
	≥1 Q (n)	2	0	2	9	3	2	3	1
	≥2 Q (n)	0	0	1	6	2	1	0	1
	≥3 Q (n)	0	0	1	3	2	0	0	1
	≥4 Q (n)	0	0	1	1	0	0	0	1
IP									
	Mean (SD)	0.1 (0.4)	0.1 (0.3)	0.5 (0.8)	1.9 (1.9)	0.6 (1.1)	0.1 (0.4)	0.2 (0.6)	0.1 (0.6)
	≥1 Q (n)	0	1	7	13	3	0	3	0
	≥2 Q (n)	0	0	4	11	2	0	1	0
	≥3 Q (n)	0	0	0	6	2	0	0	0
	≥4 Q (n)	0	0	0	3	1	0	0	0

Abbreviations. Q: SIJ quadrants with BMO. ≥1/2/3/4 Q (n): number of subjects (n) with ≥2/3 readers indicating ≥1/2/3/4 SIJ quadrants with BMO.

Conclusions: In hobby and professional athletes, BMO showed on average in 3–4 SIJ quadrants. The posterior lower ilium was the SIJ region most frequently affected by BMO. These findings in healthy controls may help refine thresholds for a positive SIJ MRI in early SpA.

References:
[1] Weber U et al. Curr Rheumatol Rep 2016;18:58.

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OP0118   **IMPACT OF RADIOGRAPHIC DAMAGE IN THE SACROILIAC JOINTS ON FUNCTION AND SPINAL MOBILITY IN PATIENTS WITH AXIAL SPONDYLOARTHRITIS: RESULTS FROM THE GERMAN SPONDYLOARTHRITIS INCEPTION COHORT**

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Background: It has been shown in the past that the spinal mobility in patients with axial spondyloarthritis (AxSpA) is associated with spinal structural damage, disease activity parameters and spinal inflammation [1]. The impact of radiographic damage in the sacroiliac joints on functional parameters in patients with axial spondyloarthritis has not been investigated so far.

Objectives: To analyze the association between radiographic sacroiliitis and parameters of the functional status and spinal mobility in patients with axSpA.

Methods: Altogether 210 patients with definite axSpA (115 with radiographic and 95 with non-radiographic axSpA) from the German Spondyloarthritis Inception Cohort (GESPIC) were included in the current study. Radiographs of sacroiliac joints were obtained at baseline and after 2 years of the follow up and were scored by two trained readers according to the conventional grading system of the modified New York criteria (grade 0 to 4 per joint). A mean of two readers score for each joint and a sum score for both SIJ were calculated for each patient, giving a total sacroiliitis score between 0 and 8. Functional status and spinal mobility were assessed by means of the Bath Ankylosing Spondylitis Functional Index (BASFI) and the Bath Ankylosing Spondylitis Metrology Index (BASMI), respectively. Both baseline and year 2 data were included in the longitudinal mixed models analysis that was corrected for the dependencies between the two time-point values of each individual and adjusted for the structural damage in the spine (modified Stoke Ankylosing Spondylitis Spine Score - mSASSS), disease activity (the Bath Ankylosing Spondylitis Disease Activity Index – BASDAI and level of C-reactive protein – CRP), and sex.

Results: In the longitudinal mixed model analysis adjusted for the presence of structural damage in the spine (mSASSS), disease activity (BASDAI and CRP) and sex, radiographic sacroiliitis demonstrated an independent association with the BASFI: β=0.10 (95% CI 0.01–0.19) and the BASMI: β=0.12 (95% CI 0.03–0.21), respectively – table. These data indicate that change by one radiographic sacroiliitis grade in one sacroiliac joint is associated with a BASFI/BASMI worsening by 0.10/0.12 points independently of structural damage in the spine and disease activity. Assuming linear association, progression of radiographic sacroiliitis from grade 0 bilaterally to grade 4 bilaterally would result in a worsening by 0.8 points in BASFI and 0.96 points in BASMI. Sensitivity analysis performed in radiographic and non-radiographic axSpA subgroups provided similar results for both outcomes.

Conclusions: Radiographic damage in the sacroiliac joints might have an impact,