

# Diffuse Idiopathic Skeletal Hyperostosis in Psoriatic Arthritis

Amir Haddad, Arane Thavaneswaran, Sergio Toloza, Vinod Chandran, and Dafna D. Gladman

**ABSTRACT. Objective.** To determine the prevalence of diffuse idiopathic skeletal hyperostosis (DISH) in patients with psoriatic arthritis (PsA) and to identify the features associated with its occurrence.

**Methods.** Patients were recruited from the University of Toronto PsA observational cohort initiated in 1978. All patients fulfilled the CASPAR criteria. Radiographs of peripheral joints and spine were obtained every 2 years. DISH was defined as flowing bony bridges in at least 4 contiguous thoracic vertebrae. Each PsA patient with DISH was matched by sex to 3 PsA patients without DISH. Demographics, disease characteristics, and radiographic features were compared using McNemar test, Fisher's exact test, chi-square test, and paired t test as appropriate. Logistic regression analyses models with stepwise regression were conducted.

**Results.** DISH was observed in 78 (8.3%) of 938 patients with PsA. Patients with DISH were older and had longer disease duration, higher body mass index (BMI), and higher uric acid levels. Diabetes and hypertension were more prevalent in patients with DISH than in those without. The severity of radiographic damage to peripheral joints was also greater in patients with DISH. The presence of inflammatory back pain, HLA-B\*27 allele, and sacroiliitis was similar in both groups. Patients with DISH had more syndesmophytes and calcaneal spurs. Older age, higher BMI, and the presence of radiographic damage to peripheral joints were associated with DISH in multivariate analysis.

**Conclusion.** The diagnosis of DISH is possible in the presence of axial PsA. DISH was associated with known DISH-related factors including older age and high BMI, as well as the presence of radiographic damage to peripheral joints. (First Release June 15 2013; J Rheumatol 2013;40:1367–73; doi:10.3899/jrheum.121433)

## Key Indexing Terms:

PSORIATIC ARTHRITIS

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From the Centre for Prognosis Studies in the Rheumatic Diseases University Health Network, Toronto Western Hospital, Toronto, Ontario, Canada; and the Rheumatology Department, Hospital San Juan Bautista, Catamarca, Argentina.

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A. Haddad, MD, Clinical Research Fellow, Division of Rheumatology, Department of Medicine, University of Toronto Psoriatic Arthritis Program, Centre for Prognosis Studies in the Rheumatic Diseases, University Health Network, Toronto Western Hospital; A. Thavaneswaran, MMath, Biostatistician, University of Toronto Psoriatic Arthritis Program, Centre for Prognosis Studies in the Rheumatic Diseases, University Health Network, Toronto Western Hospital; S. Toloza, MD, Rheumatology Department, Hospital San Juan Bautista; V. Chandran, MBBS, MD, DM; D.D. Gladman, MD, FRCPC, University of Toronto, Department of Medicine, Division of Rheumatology, University of Toronto Psoriatic Arthritis Program, Centre for Prognosis Studies in the Rheumatic Diseases, University Health Network, Toronto Western Hospital.

Address correspondence to Dr. D.D. Gladman, Centre for Prognosis Studies in the Rheumatic Diseases, Toronto Western Hospital, 399 Bathurst Street, 1E-410B, Toronto, Ontario M5T 2S8, Canada.

E-mail: dafna.gladman@utoronto.ca

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Diffuse idiopathic skeletal hyperostosis (DISH) is a condition characterized by calcification and ossification of soft tissues, ligaments, and entheses leading to presence of flowing bony bridges in the anterolateral aspect of the thoracic spine and peripheral enthesopathy as defined by Utsinger in 1985<sup>1</sup>.

DISH is more common in men than women and the incidence varies by population and increases with age, rarely being diagnosed before the age of 40 years<sup>2,3,4</sup>. Frequent clinical manifestations of DISH include dorsolumbar stiffness and pain, peripheral bone pain, and enthesitis. The diagnostic criteria of DISH as proposed by Resnick and Niwayama<sup>5</sup> include the presence of flowing calcification and ossification of the anterolateral aspect of at least 4 contiguous vertebral bodies of the thoracic spine, preservation of the intervertebral disc space, and the absence of apophyseal joints or sacroiliac inflammatory changes. However, they did not take into consideration the presence of enthesal involvement that is included in the Utsinger criteria.

While the cause of DISH remains unknown, several

factors have been proposed as etiologic triggers including mechanical<sup>6</sup>, metabolic<sup>7</sup>, and environmental ones, including diet or medications<sup>8,9</sup>.

It is also known that DISH may coexist with other rheumatologic conditions. Mata, *et al* found no association between rheumatoid arthritis (RA) and DISH<sup>10</sup>. However, patients with DISH and RA were found to have atypical radiographic features, with less destructive bone disease and a tendency to heal erosions more quickly<sup>11</sup>. DISH is also found in patients with ankylosing spondylitis (AS), as both diseases produce bone proliferations in the later phases of their course, causing limitation in spinal mobility and postural abnormalities, although the bone proliferation and the radiologic spinal findings are dissimilar<sup>12</sup>. Paravertebral ossification in psoriatic arthritis (PsA) was first described by Bywaters and Dixon in 4 male patients with psoriasis and polyarthritis who were receiving glucocorticoid therapy<sup>13</sup>. They exhibited extensive paraspinal ossification in the thoracic and lumbar spine with sparing of sacroiliac and apophyseal joints compatible with DISH.

In patients with PsA, increased prevalence of DISH could be mediated by metabolic/endocrine factors that are also prevalent in PsA (e.g., diabetes mellitus or metabolic syndrome), as well as the relatively older age at disease onset, leading to bone deposition at the entheses by activation of chondrocytes lying in the enthesal region bordering the bony interface<sup>14</sup> that is different from the immune-mediated inflammatory pathway associated with enthesitis and osteitis<sup>15</sup>.

Distinguishing these 2 conditions has therapeutic and prognostic implications. The purpose of our study was to investigate the prevalence of DISH in patients with PsA and to identify features associated with its occurrence.

## MATERIALS AND METHODS

Patients with PsA were recruited from the University of Toronto prospective observational PsA cohort, which began recruiting patients in 1978. All patients fulfilled the Classification for Psoriatic ARthritis (CASPAR) criteria<sup>16</sup> and were assessed at baseline and every 6–12 months according to a standard protocol that included a detailed history, physical examination including spinal mobility measurements<sup>17</sup>, and laboratory evaluation. Radiographs of peripheral joints and anteroposterior and lateral spine were obtained every 2 years. Damage to peripheral joints was scored based on the modified Steinbrocker method<sup>18</sup>, sacroiliitis based on the New York criteria, and spinal involvement by the modified Stoke Ankylosing Spondylitis Spinal Score method (mSASSS)<sup>19</sup>. DISH was defined as flowing bony bridges on the right aspect of at least 4 contiguous thoracic vertebrae seen on anteroposterior view and also confirmed to be flowing on the lateral thoracic spine radiograph, irrespective of the presence of radiographic sacroiliitis on the last available radiographic assessment.

Within the PsA cohort recruited between 1978 and 2012, each PsA patient with DISH was matched by sex to 3 PsA patients without DISH recruited within 1 year. Demographics and disease characteristics were compared in both groups including age, disease duration, body mass index (BMI), comorbidities (myocardial infarction, angina, diabetes), and uric acid levels. Radiographic features that were assessed included sacroiliitis (based on the New York criteria), presence of syndesmophytes (classical and/or paramarginal) at cervical and lumbar spine, and the presence of

calcaneal spurs. PsA-related changes (syndesmophytes) were considered if there was a growth angle  $< 45^\circ$  to the anterior vertebral side, while an angle  $> 45^\circ$  was considered to be osteophytes (spondylophytes)<sup>20</sup>. However, only the presence of syndesmophytes is recorded on the database. Radiographs were read by at least 2 rheumatologists by consensus.

Descriptive analyses and comparisons were conducted using the McNemar test, Fisher's exact test, and chi-square test for categorical variables and paired t tests for continuous variables. Conditional logistic regression analyses of specific covariates using univariate and multivariate models with stepwise regression were conducted.

## RESULTS

Of 938 patients with PsA recruited to the study since 1978, 78 patients (57 males, 21 females) with DISH were identified, with a prevalence of 8.3%. Table 1 depicts the comparison between patients with DISH and the control PsA patients without DISH.

Patients with DISH were older (62.9 vs 49.3 yrs;  $p < 0.0001$ ), had a longer disease duration (15.1 vs 12.8 yrs;  $p = 0.03$ ), a higher BMI (32.9 vs 28.7;  $p < 0.0001$ ), more diabetes (28% vs 9.8%;  $p < 0.0001$ ), more hypertension (50% vs 24.9%;  $p < 0.0001$ ), and elevated uric acid levels (16% vs 7%;  $p = 0.01$ ).

Axial metrology was more restricted in patients with DISH. They had a higher Bath AS Metrology Index (BASMI) score compared to patients without DISH (5.8 vs 5.1,  $p < 0.0001$ ) and in particular a decreased mean cervical rotation ( $63.1^\circ$ ,  $62.9^\circ$  vs  $73.8^\circ$ ,  $73.9^\circ$ ;  $p < 0.0001$ ), decreased chest expansion (4.9 cm vs 6.6 cm;  $p = 0.0002$ ), decreased lateral flexion of the lumbar spine (13.8, 13.0 cm vs 17.1, 17.5 cm;  $p < 0.0001$ ), and decreased Schober test (4.4 cm vs 4.7 cm;  $p = 0.02$ ). They also had more postural abnormalities as demonstrated by increased occiput to wall distance (3.7 cm vs 1.1 cm;  $p < 0.0001$ ).

The clinically damaged joint count and the modified Steinbrocker score were also higher in patients with DISH than those without DISH (11.9 vs 6.7;  $p < 0.0001$ ; and 32.0 vs 19.5;  $p = 0.0001$ , respectively). The mean erythrocyte sedimentation rate (ESR) was higher in patients with DISH (20.6 vs 14.4;  $p < 0.0001$ ), although C-reactive protein (CRP) levels were similar. No difference was found with respect to active joint count at first clinic visit. Patients with DISH had a higher mean Health Assessment Questionnaire (HAQ) score (0.86 vs 0.56;  $p = 0.0007$ ).

The presence of inflammatory back pain, HLA-B\*27 allele, and radiographic sacroiliitis of either grade was similar in the 2 groups. However, patients with DISH had more grade IV sacroiliitis (14.5% vs 7.8%;  $p = 0.01$ ) and they were more likely to have classical and paramarginal syndesmophytes (38.5% vs 18.7%;  $p < 0.0001$ ) compared to patients without DISH.

Both groups had similar treatment background at baseline with respect to nonsteroidal antiinflammatory drugs, disease-modifying antirheumatic drugs, and biologics, as well as ultraviolet therapy (UVT), as shown in Table 1.

Table 1. Demographic and disease characteristics by presence of diffuse idiopathic skeletal hyperostosis (DISH).

Characteristic	DISH,		p*
	Mean (SD) or Frequency (%) Yes, n = 78	No, n = 234	
Age, yrs	62.9 (8.9)	49.3 (12.8)	< 0.0001
Age at diagnosis of psoriasis, yrs	39.1 (15.4)	28.3 (14.1)	< 0.0001
Age at diagnosis of PsA, yrs	48.0 (13.0)	36.5 (12.1)	< 0.0001
Duration of psoriasis, yrs	23.9 (14.7)	21.0 (13.1)	0.01
Duration of PsA, yrs	15.1 (11.7)	12.8 (10.3)	0.03
Sex, males/females (%)	57 (73.1)/21 (26.9)	171 (73.4)/62 (26.6)	NS
Body mass index	32.9 (5.6)	28.7 (5.8)	< 0.0001
Obesity (%)	31 (70.5)	50 (33.8)	< 0.0001
Enthesitis (%)	8 (10.3)	26 (11.2)	0.88
Damaged joint count	11.9 (16.4)	6.7 (11.6)	< 0.0001
Active joint count	10.5 (10.9)	8.1 (9.3)	0.27
Diabetes (%)	21 (28.0)	22 (9.8)	< 0.0001
Hypertension (%)	39 (50.0)	58 (24.9)	< 0.0001
Angina (%)	3 (3.9)	3 (1.3)	0.15
Myocardial infarction (%)	2 (3.1)	2 (1.1)	0.25
Inflammatory back pain (%)	10 (18.5)	36 (21.7)	0.88
C-reactive protein	10.8 (12.5)	10.0 (13.5)	0.79
Erythrocyte sedimentation rate	20.6 (16.9)	14.4 (15.4)	< 0.0001
Elevated uric acid levels (%)	12 (16.0)	15 (7.0)	0.01
NSAID (%)	45 (72.6)	131 (66.5)	0.26
DMARD (%)	39 (61.9)	124 (63.9)	0.63
Biologics	14 (28.0)	55 (31.8)	0.69
UVT (%)	8 (11.0)	30 (13.9)	0.53
Radiographic damage (%)	66 (84.6)	158 (67.8)	< 0.0001
Modified Steinbrocker score (%)	32.0 (39.8)	19.5 (31.4)	0.0001
Calcaneal spurs (%)	65 (83.3)	142 (60.9)	< 0.0001
Syndesmophytes (%)	30 (38.5)	43 (18.7)	< 0.0001
Classical	24 (30.8)	32 (13.9)	< 0.0001
Paramarginal	18 (23.1)	21 (9.1)	< 0.0001
Sacroiliitis (%)	37 (47.4)	110 (47.2)	0.70
Grade IV sacroiliitis (%)	11 (14.5)	18 (7.8)	0.01
HLA-B27	8 (11.8)	30 (14.8)	0.42
HLA-C6 (%)	13 (19.1)	58 (28.6)	0.02
HAQ score	0.86 (0.74)	0.56 (0.62)	0.0007
BASMI score	5.8 (2.1)	5.1 (2.6)	< 0.0001
Left cervical spine rotation, degrees	63.1 (19.6)	73.8 (15.9)	< 0.0001
Right cervical spine rotation, degrees	62.9 (18.3)	73.9 (17.1)	< 0.0001
Occiput to wall distance, cm	3.7 (5.2)	1.1 (4.9)	< 0.0001
Tragus to wall distance, cm	13.2 (4.1)	12.0 (8.2)	0.09
Modified Schober's test, cm	4.4 (1.3)	4.7 (1.2)	0.02
Internal rotation of hip, cm	29.8 (12.4)	36.4 (11.5)	< 0.0001
Intermalleolar distance, cm	95.1 (23.3)	105.9 (24.4)	< 0.0001
Left lateral flexion**, cm	13.8 (6.4)	17.1 (4.5)	< 0.0001
Right lateral flexion**, cm	13.0 (4.5)	17.5 (4.6)	< 0.0001
INSPIRE method, cm	26.2 (11.2)	32.2 (9.6)	< 0.0001
Chest expansion at xyphisternum, cm	4.9 (1.7)	6.6 (6.6)	0.0002

\* McNemar test for categorical variables and paired t test for continuous variables (takes matching into consideration). \*\* DOMJAN method. PsA: psoriatic arthritis; NSAID: nonsteroidal antiinflammatory drug; DMARD: disease-modifying antirheumatic drug; HAQ: Health Assessment Questionnaire; BASMI: Bath Ankylosing Spondylitis Metrology Index; UVT: ultraviolet therapy.

Patients with DISH were stratified into 2 groups based on the presence of syndesmophytes and sacroiliitis. As expected, more patients with DISH and syndesmophytes had sacroiliitis (66% vs 38%;  $p = 0.02$ ) than patients with no syndesmophytes, as shown in Table 2. These patients,

however, were not older (61.7 vs 63.7 yrs;  $p = 0.33$ ) and had similar BMI (33.9 vs 32.4;  $p = 0.4$ ) but interestingly, had more diabetes (41.4% vs 19.6%;  $p = 0.04$ ) compared to patients without syndesmophytes. On the other hand, patients with sacroiliitis had a higher mean damaged joint

Table 2. Demographic and disease characteristics in patients with diffuse idiopathic skeletal hyperostosis (DISH) by presence of syndesmophytes (n = 78).

Characteristic	Syndesmophytes, Mean (SD) or Frequency (%)		p*
	Yes, n = 30	No, n = 48	
Age, yrs	61.7 (8.0)	63.7 (9.4)	0.33
Sex, males/females (%)	25 (83.3)/5 (16.7)	32 (66.7)/16 (33.3)	0.11
Age at diagnosis of psoriasis, yrs	33.3 (14.8)	42.9 (14.8)	0.007
Age at diagnosis of PsA, yrs	45.6 (12.6)	49.4 (13.2)	0.21
Duration of psoriasis, yrs	28.4 (15.2)	21.1 (13.7)	0.03
Duration of PsA, yrs	16.0 (12.2)	14.5 (11.5)	0.58
Body mass index	33.9 (6.8)	32.4 (4.8)	0.40
Obesity (%)	13 (76.5)	18 (66.7)	0.74
Diabetes (%)	12 (41.4)	9 (19.6)	0.04
Hypertension (%)	17 (56.7)	22 (45.8)	0.35
Angina (%)	3 (10.3)	0 (0.0)	0.05
Myocardial infarction (since last visit, %)	2 (8.3)	0 (0.0)	0.14
Enthesitis (%)	1 (3.3)	7 (14.6)	0.14
Inflammatory back pain (%)	2 (11.1)	8 (22.2)	0.47
Erythrocyte sedimentation rate	20.4 (14.3)	20.8 (15.4)	0.91
C-reactive protein	12.2 (10.2)	10.1 (13.6)	0.64
Elevated uric acid levels (%)	5 (17.2)	7 (15.2)	1.00
Damaged joint count	13.1 (16.4)	11.1 (16.4)	0.60
Radiographic damage (%)	24 (80.0)	42 (87.5)	0.52
Modified Steinbrocker score	35.1 (37.3)	30.0 (41.6)	0.59
Calcaneal spurs (%)	26 (86.7)	39 (81.3)	0.53
Sacroiliitis (%)	19 (65.5)	18 (38.3)	0.02
HLA-B*27 (%)	5 (20.0)	3 (7.0)	0.13
HLA-C*06 (%)	6 (24.0)	7 (16.3)	0.53

\* Using t tests for continuous variables and Fisher's exact test and chi-square test for categorical variables. PsA: psoriatic arthritis.

count (15.9 vs 8.2;  $p = 0.04$ ) and modified Steinbrocker score (44.1 vs 20.7;  $p = 0.01$ ) compared to patients without sacroiliitis. Other clinical features, however, were not significantly different, as shown in Table 3.

The prevalence of HLA-B\*27 was 11.8% among patients with DISH but was higher (20%) in patients with DISH and syndesmophytes compared to patients with DISH and no syndesmophytes (7%). However, no statistically significant difference was found in the prevalence of HLA-B\*27 with respect to the presence of radiographic sacroiliitis.

More patients with PsA and DISH were found to have calcaneal spurs on radiographs (83.3% vs 60.9%;  $p < 0.0001$ ), but did not have more clinical evidence of enthesitis.

Conditional logistic regression analysis showed that older age, higher BMI, diabetes, and presence of radiographic damage were associated with DISH in univariate analysis. However, only older age, higher BMI, and the presence of radiographic damage were independently associated with DISH in the multivariate reduced model, with OR of 1.12 (95% CI 1.07–1.18), 1.19 (95% CI 1.10–1.29), and 3.44 (95% CI 1.06–11.16), respectively (Table 4).

## DISCUSSION

To our knowledge, this is the first study to investigate the prevalence and characteristics of DISH in PsA. We have shown that the diagnosis of DISH is possible in the presence of axial PsA and that it was associated with known related metabolic risk factors.

In our cohort, the prevalence of DISH was comparable to that reported in several population-based studies on people age 65 years or older. For instance, in a population-based study in Finland, among those over age 70 years, the prevalence was 10.1% in men and 6.8% in women<sup>21</sup>. In a study conducted in Budapest, the prevalence in those over age 50 years was 4.9% in men and 1.4% in women<sup>3</sup>. Pima Indians in Arizona, USA, have a particularly high prevalence of DISH, 48% in men and 12% in women over the age of 55 years<sup>4</sup>.

We found that PsA patients with DISH had decreased quality of life as well as increased limitation in spinal mobility and postural abnormalities compared to PsA patients without DISH. Moreover, DISH in our cohort was associated with known DISH-related factors including older age and increased BMI, diabetes, and hypertension. Because patients with PsA are at increased risk for cardiovascular

Table 3. Demographic and disease characteristics in patients with diffuse idiopathic skeletal hyperostosis (DISH) by presence of sacroiliitis (n = 76\*).

Characteristic	Sacroiliitis, Mean (SD) or Frequency (%)		p**
	Yes, n = 37	No, n = 39	
Age, yrs	62.5 (8.3)	63.0 (9.0)	0.81
Age at diagnosis of psoriasis, yrs	37.8 (16.9)	39.9 (14.1)	0.56
Age at diagnosis of PsA, yrs	48.2 (11.7)	47.3 (14.6)	0.78
Duration of psoriasis, yrs	24.7 (16.6)	23.4 (13.0)	0.70
Duration of PsA, yrs	14.3 (11.2)	15.9 (12.3)	0.55
Sex, males/females (%)	30 (81.1)	25 (64.1)	0.10
Body mass index	33.3 (5.8)	32.1 (5.1)	0.47
Obesity (%)	16 (76.2)	14 (63.6)	0.37
Enthesitis (%)	2 (5.4)	5 (12.8)	0.43
Damaged joint count	15.9 (19.7)	8.2 (11.8)	0.04
Diabetes (%)	13 (38.2)	8 (20.5)	0.10
Hypertension (%)	15 (40.5)	22 (56.4)	0.17
Angina (%)	2 (5.6)	1 (2.6)	0.51
Myocardial infarction (since last visit; %)	0 (0)	2 (6.1)	0.49
Inflammatory back pain (%)	6 (24.0)	4 (14.8)	0.49
Erythrocyte sedimentation rate	25.1 (17.9)	17.1 (15.5)	0.05
C-reactive protein	13.5 (16.6)	9.7 (9.3)	0.44
Elevated uric acid levels (%)	5 (14.3)	7 (18.4)	0.76
Radiographic damage (%)	32 (86.5)	32 (82.1)	0.60
Steinbrocker score	44.1 (48.2)	20.7 (26.5)	0.01
Calcaneal spurs (%)	28 (75.7)	35 (89.7)	0.10
HLA-B*27 (%)	4 (13.3)	4 (10.8)	NS
HLA-C*06 (%)	5 (16.7)	8 (21.6)	0.61

\* Information on sacroiliitis was not available for 2 patients. \*\* Using t test for continuous variables and Fisher's exact test and chi-square test for categorical variables. PsA: psoriatic arthritis; NS: nonsignificant.

Table 4. Conditional logistic regression analyses of variables associated with diffuse idiopathic skeletal hyperostosis (DISH).

Covariate	Univariate Model		Multivariate Model			
	OR (95% CI)	p	Full Model OR (95% CI)	p	Reduced Model* OR (95% CI)	p
Age (1 yr increase)	1.12 (1.08, 1.15)	< 0.0001	1.13 (1.07, 1.19)	< 0.0001	1.12 (1.07, 1.18)	< 0.0001
Duration of psoriatic arthritis (1 yr increase)	1.02 (0.996, 1.05)	0.10	0.98 (0.94, 1.02)	0.36	—	—
Body mass index (1 unit increase)	1.13 (1.06, 1.20)	0.0001	1.18 (1.09, 1.28)	< 0.0001	1.19 (1.10, 1.29)	< 0.0001
Diabetes (Yes vs No)	3.47 (1.78, 6.76)	0.0003	1.56 (0.56, 4.36)	0.39	—	—
Radiographic damage (Yes vs No)	2.58 (1.32, 5.05)	0.0006	5.20 (1.36, 19.88)	0.02	3.44 (1.06, 11.16)	0.04

\* Stepwise regression analysis.

morbidities, the presence of DISH, with its associated metabolic features, may identify patients at higher risk<sup>22</sup>.

Patients with DISH were found to have more clinical as well as radiographic damage from PsA, compared to their matched controls. We find that interesting, because DISH clearly could affect the peripheral joints as well as the entheses<sup>23,24</sup>, but the mechanism of involvement is likely different. The radiographic changes that we had recorded were attributed to PsA and the multivariate analysis

confirmed that radiographic damage to the peripheral joints was independently associated with PsA and DISH. Therefore DISH may be a marker for severe disease that does not necessarily share the same mechanism, but is driven synergistically by coexisting underlying factors.

As for enthesitis, in general, the bony proliferations in spondyloarthritis (SpA) are ill-defined and finely speculated<sup>25</sup> and the calcaneal spurs in PsA in particular are characterized by fluffy plantar periostitis and broad-based

and midsegment dimensions<sup>26</sup>. Using other imaging modes such as power Doppler ultrasound, the presence of any vascularized enthesis has a very good sensitivity and specificity for the diagnosis of SpA<sup>27</sup>. In DISH, on the other hand, the bony proliferations are coarse and well margined<sup>24</sup>, and there are no studies to our knowledge that have investigated the role of ultrasound in DISH. Magnetic resonance imaging findings in spondyloarthropathy are also not specific<sup>25</sup>. Our finding that patients with DISH had more spurs, but with no enthesitis, is consistent with the notion that different pathways are operating in the 2 conditions.

We have shown that the diagnosis of DISH was possible in the presence of psoriatic spondylitis. Some patients had no evidence of axial disease. Others had DISH in the presence of syndesmophytes and/or sacroiliitis, as illustrated in Figure 1.

Some patients had both syndesmophytes and spondylophytes that are known to have different underlying pathological mechanisms. The formation of syndesmophytes in PsA is asymmetrical and mostly paramarginal as a result of inflammation and remodeling processes at the discovertebral junction that result in gradual ossification of the periphery of the annulus fibrosus and the formation of vertical bony bridges<sup>28</sup>, whereas spondylophytes are a result of ossification along the anterior longitudinal ligament and to a lesser extent the paravertebral connective tissue and the peripheral part of the annulus fibrosus<sup>5,29</sup>.

Nevertheless, we found that the presence of grade IV sacroiliitis and syndesmophytes was higher in patients with DISH, which could support the hypothesis that an inflammatory mechanism is playing a role in such cases. On the other hand, since DISH may also involve the sacroiliac joints<sup>12</sup> by ossification of the joint capsule, it might be mistakenly interpreted as articular ankylosis due to sacroiliitis. Other imaging modalities such as computed tomography may be required to differentiate the 2 conditions.

A limitation of our study may be that all assessments of radiographs were made by nonblinded observers, which could have impeded the reliability of scoring. However, the radiographs were read by consensus of at least 2 rheumatologists. We did not use the published criteria for DISH, as for the purpose of this study we needed to allow the presence of sacroiliitis and syndesmophytes. There is also a possibility that our interpretation for a syndesmophyte or DISH was misclassified since they could have looked misleading on radiographs. Further investigation using other imaging modalities is required to understand the character of the bone formation in PsA patients with DISH.

We have shown that the diagnosis of DISH is possible in the presence of axial PsA. DISH is associated with known DISH-related factors including older age and high BMI, as well as the presence of radiographic damage to peripheral joints. Thus, the presence of DISH is a marker of severe disease in PsA.



Figure 1. Patient with psoriatic arthritis with DISH, sacroiliitis, and syndesmophytes at the cervical spine. Note the space between the anterior vertebral line and the bridging flowing calcifications on the lateral thoracic spine radiograph (arrows), the presence of grade 2 sacroiliitis, and cervical syndesmophytes (marked by asterisks). DISH: diffuse idiopathic skeletal hyperostosis.

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