Juvenile Psoriatic Arthritis: Longterm Outcome and Differentiation from Other Subtypes of Juvenile Idiopathic Arthritis

BERIT FLATØ, GUNNHILD LIEN, ANNA SMERDEL-RAMOYA, and ODD VINJE

ABSTRACT. ***Objective.*** To compare outcomes in patients with juvenile psoriatic arthritis (PsA) with those in patients with other juvenile idiopathic arthritis (JIA) subtypes, and to evaluate characteristics and genetic markers that may differentiate PsA from other subtypes of JIA.

Methods. JIA patients first admitted between 1980 and 1985 were clinically examined after a median of 15 years. Health status was reassessed by the Short Form-36 Health Survey (SF-36) after a median of 23 years. Of 336 JIA patients, 31 (9%) had PsA.

Results. Predictors of PsA were psoriasis in the patient (OR 12.06, $p = 0.004$) or first-degree relative (OR 30.86, $p < 0.001$), dactylitis (OR 10.97, $p < 0.001$), and ankle/toe arthritis (OR 3.04, $p = 0.038$) within the first 6 months. HLA-DRB1*11/12 status (OR 2.69, $p = 0.040$) and onset after age 6 years (OR 4.41, $p = 0.004$) differentiated PsA from either oligoarthritis or polyarthritis. After 15 years, PsA patients had poorer physical health than healthy population controls ($p = 0.001$). After 23 years, the SF-36 physical scores were poorer in PsA patients than in those with either oligoarthritis or polyarthritis ($p < 0.045$). The need for disease-modifying antirheumatic drugs and/or anti-tumor necrosis factor agents was present in 33% of PsA versus 8% in oligoarthritis and 13% in either oligoarthritis or polyarthritis patients ($p < 0.001$ and $p = 0.002$, respectively).

Conclusion. In addition to a history of psoriasis, dactylitis, ankle or toe arthritis, and DRB1*11/12 in children with JIA indicate the likelihood of PsA, a subtype associated with unfavorable outcome.

(First Release Feb 1 2009; J Rheumatol 2009;36:642–50; doi:10.3899/jrheum.080543)

Key Indexing Terms:
JUVENILE IDIOPATHIC ARTHRITIS PSORIATIC ARTHRITIS OUTCOME ASSESSMENT
PROGNOSTIC FACTORS PEDIATRIC RHEUMATOLOGY
HUMAN LEUKOCYTE ANTIGEN

Onset of arthritis precedes the onset of psoriasis in a significant proportion of children with psoriasis-associated arthritis, often by several years[1,2]. The Vancouver criteria for juvenile psoriatic arthritis (PsA) were developed to facilitate the diagnosis of PsA before the onset of psoriasis[2]. However, substantial clinical and genetic heterogeneity within PsA has been found[1-3]. In order to recognize children with a single disease entity, juvenile PsA was classified as a category of juvenile idiopathic arthritis (JIA) by the International League of Associations for Rheumatology (ILAR)[4]. Modifications of these criteria became necessary due to a large proportion of patients with unclassified arthritis[5]. Only 2 studies have described the characteristics of patients with PsA according to the ILAR criteria[6,7]. Huemer, *et al* found that in addition to dactylitis, the pattern of joint involvement facilitated the identification of children with PsA and suggested that this factor should be considered as a modification of the ILAR classification[6]. Stoll, *et al* questioned whether the restriction of the diagnosis of PsA according to the ILAR criteria reflects substantial clinical differences compared to the Vancouver criteria[7].

Several HLA-DRB1, HLA-DPB1, and HLA-B27 genes have been associated with susceptibility to various JIA subtypes. Studies on the HLA associations in PsA have provided conflicting results and no antigen has been consistently raised or decreased[2,3,8,9]. Few studies have addressed the outcome in PsA; most studies are based on limited patient numbers, and the duration of followup has varied from 2 to 11 years[1,2,6,9]. Most studies have focused on progression from oligo- to polyarthritis[1,6,10], while some authors have included the need for disease-modifying antirheumatic

From the Department of Rheumatology and Institute of Immunology, Rikshospitalet-Oslo University Hospital, Oslo, Norway.

B. Flatø, MD, PhD, Department of Rheumatology, Rikshospitalet-Oslo University Hospital; G. Lien, MD, PhD, Department of Rheumatology, Rikshospitalet-Radiumhospitalet Medical Center and Department of Rheumatology, Diakonhjemmet Hospital, Oslo; A. Smerdel-Ramoya, MSc, PhD, Institute of Immunology, Rikshospitalet-Oslo University Hospital and Department of Research, Saint Francis Hospital and Medical Center, Hartford, CT, USA; O. Vinje, MD, PhD, Department of Rheumatology, Rikshospitalet-Oslo University Hospital.

Address reprint requests to Dr. B. Flatø, Department of Rheumatology, Rikshospitalet-Oslo University Hospital, 0027 Oslo, Norway.
E-mail: berit.flato@rikshospitalet.no

Accepted for publication September 15, 2008.

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

drugs (DMARD) and joint erosions as dimensions of outcome[1,9]. Differences in the classification criteria used make the results difficult to compare. To date, the multidimensional outcomes of PsA have not been assessed.

Our aim was to assess the longterm outcome in juvenile PsA and to compare the outcome in PsA patients with that in those with other JIA subtypes. The health status in PsA patients was compared with that of controls from the general population. We also evaluated patient characteristics, clinical features, and HLA-DRB1 and DPB1 alleles that may differentiate PsA from other subtypes of JIA during the first 6 months of disease.

MATERIALS AND METHODS

Patients and controls. Three hundred thirty-six patients with JIA first admitted to the Division of Pediatric Rheumatology, Rikshospitalet Medical Center, between January 1980 and September 1985 were examined by clinical, laboratory, radiographic, and health status assessments after a median of 14.9 years (range 11.7–25.1, mean 15.0 ± 2.1) of disease duration. Thirty-one patients (9%) had PsA, 23 (7%) systemic arthritis, 95 (28%) persistent oligoarthritis, 42 (13%) extended oligoarthritis, 57 (16%) rheumatoid factor (RF)-negative polyarthritis, 11 (3%) RF-positive polyarthritis, 55 (16%) enthesitis-related arthritis (ERA), and 22 patients (6%) had undifferentiated JIA. Medical records were reviewed for variables related to onset of disease. After a median of 22.8 years of disease duration (range 19.6–31.7, mean 22.9 ± 2.0), a mailed questionnaire was sent to the 336 patients; questionnaires were completed by 28 (90%) PsA patients, 110 (80%) oligoarthritis patients, 45 (66%) polyarthritis patients, 40 (73%) of those with ERA, 17 (74%) with systemic arthritis, and 18 (82%) with undifferentiated arthritis. Characteristics of the total group of JIA patients have been described[11-13].

The patients' disease subtypes according to the ILAR criteria for JIA were determined at the followup visit after a median of 14.9 years of disease duration based on the clinical examination and chart reviews[5]. Thus, PsA was diagnosed in a child with arthritis and psoriasis, or arthritis and at least 2 of the following: psoriasis in a first-degree relative and dactylitis or nail pitting or onycholysis. Patients with signs of other JIA subtypes were excluded. Psoriasis in a patient or first-degree relative was an exclusion criterion for all other disease subtypes, except for 5 patients with ERA with signs of spondyloarthropathy (SpA) that indicated exclusion from the psoriatic arthritis group[13]. It has been suggested that if psoriasis is considered an exclusion criterion for ERA, no signs of SpA should be present[14]. At the followup visit, the patients were also classified according to the Vancouver criteria for juvenile PsA[2].

Individuals matched for age, sex, and geographic region (n = 279) were randomly selected from the national population register to serve as controls for the health status assessments at the time of the 15-year followup visit. A family history of psoriasis was not obtained from the controls. Two hundred ninety-five unrelated healthy individuals, randomly selected from the Norwegian Bone Marrow Donors Registry, served as controls for the genomic typing. The whole study was approved by the Regional Ethics Committee for Medical Research.

Clinical examinations and chart reviews. The clinical examinations after a median of 14.9 years' disease duration included assessments of the numbers of affected (swollen or mobility-restricted) joints. Psoriasis in a patient was defined as psoriasis confirmed by a dermatologist. Disease onset was the date that arthritis was documented by a physician.

Remission was defined according to the preliminary criteria for clinical remission in JIA whereby no active arthritis, fever, rash, serositis, splenomegaly, generalized lymphadenopathy or active uveitis was present, the erythrocyte sedimentation rate (ESR) or C-reactive protein level was normal, and the physician's global assessment of disease activity indicated that clinical disease quiescence had been present for at least 12 months, while the patient had not received any antiarthritis or antiuveitis medication[15]. The patients were judged to be in remission regardless of the presence or absence of active psoriasis.

Assessments of health status. The Medical Outcome Study Short Form-36 Health Survey (SF-36) was completed by patients after a median of 14.9 and 22.8 years of disease duration and by controls at the time of the 15-year followup. This 36-item questionnaire measures 2 distinct components: the physical component summary (PCS) scale, consisting of the health dimensions physical functioning, role limitations due to physical health, bodily pain, and general health, and the mental component summary (MCS) scale, consisting of vitality, social functioning, role limitation due to emotional problems, and mental health[16]. Low scores indicate that health status is poor and high scores indicate good health. The questionnaire has been translated and culturally adapted for use by Norwegians[17].

The Health Assessment Questionnaire (HAQ) was used to measure physical disability in JIA patients[18]. The HAQ is a 20-item questionnaire measuring physical function in 8 areas: dressing and grooming, arising, eating, walking, hygiene, reaching, gripping, and activities. The scores range from 0 to 3, where 0 means no difficulty with daily activities and 3, unable to perform these activities. The HAQ has been used in several studies of young adults with JIA[19].

Radiographic examinations. Radiographs of hips (anterior-posterior view), ankles (lateral view), and sacroiliac joints (anterior-posterior view) of all patients were obtained at the 15-year visit. They were independently read by 2 radiologists. The scoring system included grade 0 to 5, where grade 2 to 5 denote definite arthritic changes[11,13,20].

Genomic typing for HLA. HLA-DRB1 typing was performed by the nonisotopic method based on polymerase chain reaction (PCR) and hybridization with oligonucleotide probes labeled with biotin[21,22]. HLA-DPB1 alleles were typed by sequence-specific oligonucleotide probing using PCR[21,22]. The HLA-DRB1 associations studied included DRB1*01 (also called DR1), DRB1*04 (DR4), DRB1*11/12 (DR5), and DRB1*08 (DR8) alleles. The HLA-DPB1 associations studied included DPB1*02 and DPB1*03 alleles. HLA-B27 was determined by serologic testing.

Statistics. Differences in characteristics between 2 patient groups and between PsA patients and controls were tested with the Student 2-tailed unpaired t test for continuous variables and the chi-square test for categorical variables. Differences between more than 2 patient groups were tested by one-way ANOVA for continuous variables. Changes within a patient group over time were tested by Student 2-tailed paired t test.

In order to identify possible predictors of the diagnosis of PsA in the whole cohort of JIA patients (total n = 336) and factors that differentiated patients with PsA from those with either oligoarthritis or polyarthritis (total n = 236), logistic regression analyses were performed. The classification of PsA versus all other JIA subtypes and versus either oligoarthritis or polyarthritis was used as the dependent variable. In the PsA group, 68% of patients had oligoarticular onset, which was comparable to the 67% of patients with oligoarticular onset in either the oligoarthritis or the polyarthritis group. First, univariate logistic regression analyses were performed on the relation between PsA and patient characteristics (sex, onset age), genetic markers previously associated with childhood arthritis (HLA-B27, DRB1, and DPB1), and disease variables assessed within the first 6 months of disease duration [onset type, dactylitis, nail pitting, numbers of affected joints, persistently elevated ESR, antinuclear antibody (ANA), small-joint disease, and finger, wrist, hip, knee, ankle or toe involvement]. Psoriasis in a patient or first-degree relative was analyzed as an independent variable in the regression models including all JIA patients, but could not be included in the analyses of factors that differentiated PsA from either oligoarthritis or polyarthritis patients because these factors were exclusion criteria for the classification of oligoarthritis and polyarthritis.

Subsequent multivariate logistic regression analyses with backward deletion of possible predictors were performed to identify early determinants of PsA. Sex, age at onset, and candidate factors that were associated

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

with the classification of PsA in the univariate tests ($p < 0.10$) were analyzed. Data on the strength of the associations were expressed as odds ratios (OR) and 95% confidence intervals (95% CI). Hosmer-Lemeshow goodness-of-fit statistics were used to assess how well the logistic regression models fit the data (p values > 0.05 were considered to fit).

P values ≤ 0.05 or 1.00 not included in the 95% CI (for the OR) were considered statistically significant. SPSS version 15 software was used for all analyses.

RESULTS

Patient characteristics. The 31 patients with PsA comprised 7 men (23%) and the mean age at the followup visit was 23.3 ± 3.9 years, compared with 84 men (30%) and mean age at followup visit 22.8 ± 4.9 years in the healthy controls (not statistically significant). In patients with PsA, the mean age at disease onset was 11.4 ± 2.4 years in boys and 7.3 ± 3.4 years in girls ($p = 0.006$; Figure 1). The PsA patients were older than those with oligoarthritis and younger than those with ERA (Table 1).

Genetic markers. In patients with PsA HLA-DRB1*08 and HLA-DRB1*11/12 were increased compared with healthy controls (Table 2). HLA-DRB1*11/12 was increased and HLA-B27 was decreased in PsA compared with ERA patients. HLA-DPB1*03 was decreased in PsA patients compared with those with RF-negative polyarthritis. HLA-DRB1*11/12 was present in 4 (50%) of the PsA patients aged ≤ 6 years at disease onset and 5 (22%) of those with onset after the age of 6 (nonsignificant). The frequency of HLA-B27 was comparable in the 2 age groups (data not shown).

Early determinants of PsA. Psoriasis in a first-degree relative (OR 30.86, $p < 0.001$) or in the patient (OR 12.06, $p = 0.004$), dactylitis (OR 10.97, $p < 0.001$), and toe and/or ankle involvement (OR 3.04, $p = 0.038$) within the first 6 months were early predictors of PsA in the total cohort of patients with JIA (Table 3). HLA-DRB1*11/12 predicted the development of PsA in 4 patients; however, the association was only statistically significant in the univariate and not in the multivariate analysis. The multivariate regression model supported the data well (chi-square = 2.082, df = 4, $p = 0.721$).

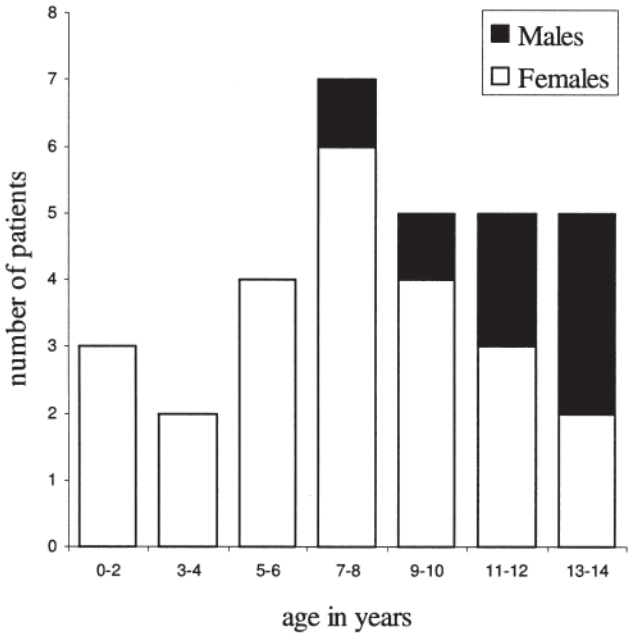

Figure 1. Age distribution at disease onset in boys and girls with juvenile psoriatic arthritis.

Onset after age 6 years (OR 4.41, $p = 0.004$), dactylitis within the first 6 months (OR 14.93, $p < 0.001$), and presence of DRB1*11/12 (OR 2.69, $p = 0.040$) differentiated PsA from either oligoarticular or polyarticular JIA. This regression model also supported the data well (chi-square = 4.130, df = 3, $p = 0.248$). Further, PsA was associated with toe and/or ankle arthritis (OR 2.62, $p = 0.022$) and hip involvement (OR 3.39, $p = 0.035$) at disease onset in the univariate, but not the multivariate, analyses. The frequency of hip arthritis in PsA was comparable in boys and girls and in patients aged ≤ 6 years at onset and older children (data not shown). PsA patients and those in either the oligoarthritis or the polyarthritis group had a similar frequency of oligoarticular onset (68% and 67%, respectively).

Patient and disease characteristics in ILAR-included and ILAR-excluded patients with PsA. Eleven (26%) of 42 patients met the Vancouver classification criteria for juvenile PsA, but were excluded from the PsA category under the ILAR criteria for JIA (Table 4).

Psoriasis started before the arthritis in 3 PsA patients (10%) and between the onset of arthritis and the first 6 months of disease duration in 3 patients (10%). Six PsA patients (19%) developed psoriasis between 6 months and median 14.9 years of disease duration. The duration between the onset of arthritis and the onset of psoriasis was median 3.8 years (range 0.2–12.3). Cumulatively, 12 (39%) of the 31 PsA patients developed psoriasis, compared with 4 (33%) of the 11 ILAR-excluded patients that met the Vancouver criteria for PsA, and none of the 22 patients with undifferentiated arthritis (Table 5). Twenty-three (74%) of the ILAR-included PsA patients had a history of psoriasis in a first-degree relative, compared with 1 (8%) ILAR-excluded patient and 19 (86%) of those with undifferentiated arthritis ($p < 0.001$ and p not significant, respectively). None of the ILAR-included and 4 (33%) of the ILAR-excluded patients developed radiographic sacroiliitis ($p < 0.01$). The ILAR-included PsA patients also had statistically significantly less inflammatory back pain and HLA-B27 than the ILAR-excluded patients. Patients with undifferentiated arthritis had less dactylitis, small joint arthritis, ankle or toe arthritis, psoriasis-like rash, and nail pitting than the patients with PsA. Six (26%) of 23 PsA patients with psoriasis in a first-degree relative developed psoriasis, compared with none of 19 patients with undifferentiated arthritis and a family history of psoriasis.

Clinical and radiographic outcome. After a median of 14.9

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

Table 1. Characteristics of patients with juvenile PsA and other subtypes of JIA. Values are numbers (%) of patients or mean ± standard deviation.

	PsA, n = 31	Oligoarthritis, n = 137	Polyarthritis, n = 68	ERA, n = 55	Undifferentiated Arthritis, n = 22	Systemic Arthritis, n = 23
Male sex	7 (23)	29 (21)	20 (35)	36 (66)***	5 (23)	10 (59)
Age at onset, range 1.7–15.2 yrs	8.2 ± 3.6	6.0 ± 4.1**	8.4 ± 4.2	11.1 ± 2.8***	6.9 ± 4.7	6.2 ± 4.4
Age at followup visit, range 13.7–31.3 yrs	23.3 ± 3.9	21.2 ± 4.6*	23.1 ± 4.2	26.5 ± 3.0***	22.4 ± 5.2	20.7 ± 4.5*
Onset age > 6 yrs	23 (74)	62 (45)**	35 (61)	51 (93)*	11 (50)	11 (48)
Disease duration at followup visit, range 11.7–25.1 yrs	15.0 ± 1.8	15.2 ± 2.3	14.7 ± 1.8	15.2 ± 2.3	15.5 ± 2.4	14.5 ± 1.3
Disease duration at postal survey, range 16.1–31.7 yrs†	22.9 ± 2.0	22.8 ± 2.2	22.4 ± 2.1	22.2 ± 2.5	22.6 ± 2.2	21.6 ± 1.8*
Oligoarticular arthritis at onset	21 (68)	137 (100)***	0***	40 (73)	19 (86)	16 (70)
Polyarticular course	20 (65)	42 (31)***	68 (100)***	37 (67)	11 (50)	13 (57)

*** p < 0.001 versus PsA; ** p < 0.01 versus PsA; * p < 0.05 versus PsA (not statistically significant when corrected for numbers of comparisons). PsA: psoriatic arthritis, ERA: enthesitis-related arthritis. † n = 28 PsA, n = 110 oligoarthritis, n = 45 polyarthritis, n = 40 ERA, n = 18 undifferentiated arthritis, n = 17 systemic arthritis.

Table 2. Numbers of patients (%) with various HLA alleles in juvenile PsA compared with other subtypes of JIA and healthy controls.

	PSA, n = 31	Persistent Oligoarthritis, n = 95	Extended Oligoarthritis, n = 42	RF-negative Polyarthritis, n = 57	RF-positive Polyarthritis, n = 11	ERA, n = 55	Systemic Arthritis, n = 23	Undifferentiated Arthritis, n = 21	Controls, n = 295
HLA-B27	6 (19)	16 (17)	5 (12)	11 (19)	1 (9)	47 (85)***	2 (9)	1 (5)	35 (12)
DRB1*01	8 (26)	14 (15)	18 (43)	5 (9)*	5 (46)	13 (24)	5 (22)	3 (14)	57 (19)
DRB1*04	6 (19)	16 (17)	6 (14)	15 (26)	6 (55)*	20 (36)	9 (39)	8 (38)	99 (34)
DRB1*11/12	9 (29)	17 (18)	7 (17)	8 (14)	1 (9)	6 (11)*	3 (13)	2 (10)	32 (11)**
DRB1*08	8 (26)	36 (38)	12 (29)	20 (35)	1 (9)	16 (29)	2 (9)	7 (33)	20 (7)***
DPB1*02	9 (29)	48 (51)*	15 (36)	13 (23)	1 (9)	12 (22)	5 (22)	7 (33)	56 (19)
DPB1*03	4 (13)	12 (13)	9 (21)	24 (42)**	4 (36)	15 (27)	6 (26)	4 (19)	59 (20)

PsA: psoriatic arthritis, ERA: enthesitis-related arthritis. RF: rheumatoid factor. *** p < 0.001 versus PsA; ** p < 0.01 versus PsA; * p < 0.05 versus PsA (not statistically significant when corrected for numbers of comparisons).

years of disease duration, psoriasis, nail pitting, and dactylitis were statistically significantly more frequent in PsA patients than in those with all other JIA sybtypes, while ANA was more frequent in PsA patients than in those with ERA (p = 0.029; Table 6). Current remission without medication for at least 12 months was found in 17 PsA patients (55%). The duration of the current remission was median 7.9 years (range 1.6–15.4). Twelve PsA patients (39%) had one or more periods of previous remission, together lasting for a median of 2.8 years (range 0.5–9.0). Radiographic joint erosions were found in 7 PsA patients (23%) compared to 31 (46%) of those with polyarthritis (p = 0.029).

After a median of 22.8 years of disease duration, 10 (33%) patients with PsA still used DMARD and/or anti-tumor necrosis factor (TNF) agents compared with 9 (8%) of those with oligoarthritis and 19 (13%) with either oligoarthritis or polyarthritis (p < 0.001 and p = 0.002, respectively). In the PsA group, 6 patients used methotrexate, one sulfasalazine, and 4 used anti-TNF agents. The need for DMARD and/or anti-TNF agents in ILAR-included PsA patients was comparable with that in ILAR-excluded patients and those with undifferentiated arthritis (data not shown). The remission rate, frequency of joint erosions, and need for DMARD and/or anti-TNF agents in PsA patients with psoriasis was not significantly different from those without psoriasis (data not shown).

Health status after a median of 14.9 and 22.8 years of disease duration. After a median of 22.8 years of disease duration, abnormal HAQ disability indexes (scores > 0.12) were found in 14 (45%) PsA patients compared with 62 (30%) of those with either oligoarthritis or polyarthritis (p = 0.098). Two PsA patients (7%) had moderate disability (HAQ scores > 1.25, but ≤ 2.0) and none had severe disability (HAQ > 2.0).

The physical functioning as assessed by the mean HAQ and SF-36 PCS scores deteriorated from a median of 14.9 to a median of 22.8 years after onset in patients with PsA (p = 0.033 and p = 0.039, respectively), but not in those with other JIA subtypes (Table 7). After median 14.9 years, the patients with PsA had poorer physical health than individuals from the general population as measured by the SF-36 PCS (p < 0.001), but not poorer than in patients with other subtypes of JIA. After a median of 22.8 years, the SF-36 PCS scores were poorer and the levels of pain intensity were higher in patients with PsA compared with those with either oligoarthritis or polyarthritis (p = 0.045 and p = 0.050,

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

Table 3. Early determinants for differentiation between juvenile PsA (n = 31) and all other JIA subtypes (n = 305) as well as oligoarticular or polyarticular JIA (n = 205).

Variables Assessed at Disease Onset	Univariate Analyses*			Multivariate Analysis**		
	OR	95% CI	p	OR	95% CI	p
PsA vs all other subtypes (n = 336)						
Female sex	1.67	0.70–4.01	0.249			
Onset age ≥ 6 yrs	1.97	0.85–4.55	0.112			
Psoriasis in first-degree relative	26.35	10.84–64.07	< 0.001	30.86	10.68–89.14	< 0.001
Psoriasis in patient	14.40	4.11–50.51	< 0.001	12.06	2.26–64.40	0.004
DRB1*11/12	2.43	1.05–5.61	0.038	3.09	0.86–9.90	0.085
Dactylitis	9.90	3.93–24.95	< 0.001	10.97	2.96–40.62	< 0.001
Small-joint arthritis	2.06	0.98–4.33	0.050			
Toe arthritis	2.17	0.97–4.85	0.061			
Ankle arthritis	1.99	0.94–4.22	0.071			
Toe and/or ankle involvement	2.73	1.22–6.13	0.015	3.04	1.07–8.64	0.038
Finger arthritis	2.03	0.95–4.33	0.067			
PsA vs oligo–/polyarthritis (n = 236)***						
Female sex	1.08	0.44–2.65	0.872			
Onset age ≥ 6 yrs	2.63	1.13–6.16	0.026	4.41	1.61–12.12	0.004
DRB1*11/12	2.13	0.90–5.04	0.085	2.69	1.05–6.91	0.040
Dactylitis	3.40	3.19–22.10	< 0.001	14.93	4.79–47.54	< 0.001
Ankle arthritis	1.92	0.89–4.12	0.096			
Toe arthritis	2.09	0.91–4.80	0.082			
Toe and/or ankle involvement	2.62	1.15–5.96	0.022			
Hip involvement	3.39	1.09–10.54	0.035			

* DRB1*01, DRB1*04, DPB1*02, DPB1*03, wrist or knee arthritis, nail pitting, ANA, persistently elevated ESR, and cumulative numbers of affected joints within the first 6 months of disease were not associated with diagnosis of PsA in univariate analyses (p ≥ 0.10, data not shown). ** Results of multiple logistic regression analysis identifying determinants of diagnosis of PsA. Variables associated with PsA in univariate analyses (p < 0.10) were included. *** Psoriasis in patient or relative is an exclusion criterion from oligoarthritis and polyarthritis and could not be analyzed as an independent variable in the analyses of factors that differentiated PsA from either oligoarthritis or polyarthritis.

Table 4. Numbers of patients with juvenile PsA according to Vancouver and ILAR criteria and reason for exclusions.

Vancouver Criteria	Vancouver PsA	PsA	ILAR Category			
			Oligoarthritis	Polyarthritis	ERA*	Undifferentiated
Total no. of patients	42	31	2	3	5	1
No. included under ILAR criteria	31	31				
No. excluded under ILAR criteria	11		2	3	5	1
Reason for exclusion						
Psoriasis-like rash	4		1	2	1	
B27-positive male onset-age > 6 yrs	3				3	
Psoriasis in 2nd-degree relative	2		1	1		
Meets criteria for AS	1				1	
Positive IgM rheumatoid factor	1					1

* 5 patients excluded from PsA because they met inclusion criteria for ERA had psoriasis in patient or first-degree relative and thus met the criteria for more than one category. However, since they all had signs of spondyloarthropathy they were analyzed together with the ERA patients.

respectively), but not compared with ERA patients. The health status in patients with systemic arthritis or undifferentiated JIA or PsA according to the Vancouver but not the ILAR criteria did not differ significantly from those with PsA (data not shown).

DISCUSSION

In our study, physical health at last assessment in patients with juvenile PsA was poorer than in controls and patients with either oligoarticular or polyarticular JIA, but not poorer than those with ERA. Physical limitations worsened from a median of 15 to 23 years of disease duration in PsA patients only. The need for DMARD and/or anti-TNF agents after 23 years was greater in patients with PsA than in those with oligoarthritis and tended to be greater than in those with polyarthritis. A history of psoriasis in a patient or first-degree relative, dactylitis, and ankle or toe arthritis within the first 6 months were early predictors of PsA in children

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

Table 5. Characteristics of ILAR-included patients with juvenile PsA, and patients excluded from the ILAR PsA category. Values are number (%) of patients or mean ± standard deviation.

	Included PsA Patients, n = 31	Vancouver-included, but ILAR-excluded patients†, n = 11	Patients with Undifferentiated Arthritis, n = 22
Female sex	7 (23)	6 (50)	17 (77)
Age at onset, mean ± SD, yrs	8.2 ± 3.6	10.2 ± 4.4	7.0 ± 4.6
Psoriasis in first-degree relative	23 (74)	1 (8)***	19 (86)
HLA-B27	6 (19)	6 (50)*	1 (5)
Variables assessed within first 6 months			
Psoriasis confirmed by a dermatologist	6 (19)	3 (25)	0*
Psoriasis-like rash	1 (4)	1 (8)	0
Nail pitting	1 (3)	4 (33)*	0
Dactylitis	10 (32)	4 (33)	1 (5)**
Oligoarthritis	21 (68)	6 (50)	19 (86)
Any small joint	16 (52)	6 (50)	4 (18)*
Ankle or toe arthritis	22 (71)	4 (33)*	5 (23)**
Variables assessed median 15 yrs after onset			
Psoriasis confirmed by a dermatologist	12 (39)	4 (33)	0**
Psoriasis-like rash	6 (19)	5 (46)	0*
Nail pitting	8 (26)	4 (33)	0**
Dactylitis	13 (42)	4 (33)	1 (5)**
Polyarthritis	20 (65)	10 (83)	11 (50)
Joint involvement			
Any small joint	20 (65)	9 (75)	9 (41)
Any large joint	30 (97)	12 (100)	20 (91)
Hip	7 (23)	4 (33)	2 (9)
Knee	27 (87)	12 (100)	17 (77)
Ankle	22 (71)	8 (67)	8 (36)*
Toe	13 (42)	7 (58)	3 (14)*
Elbow	10 (33)	8 (67)	8 (36)
Wrist	13 (42)	8 (67)	9 (41)
Finger	19 (61)	8 (67)	8 (36)
Chronic uveitis	6 (19)	0	7 (32)
Enthesitis	1 (3)	2 (17)	1 (5)
Inflammatory back pain	0 (0)	4 (33)**	1 (5)
Reduced Schober's test	4 (13)	3 (25)	5 (24)
Radiographic sacroiliitis	0	4 (33)**	1 (5)

† Patients fulfilled the Vancouver but not the ILAR criteria for juvenile PsA. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$ versus ILAR-included PsA patients.

with all JIA subtypes. Additionally, onset after the age of 6 years and HLA-DRB1*11/12 status differentiated PsA patients from those with either oligoarthritis or polyarthritis. PsA patients were younger at onset, comprised fewer men, and were more often HLA-DRB1*11/12-positive and less often HLA-B27-positive than those with ERA. To date, this is the first description of longterm outcome and early predictors of diagnosis in juvenile PsA according to the ILAR classification criteria.

The patients with PsA were part of a cohort of all new JIA cases who attended hospital during a 5-year period. Being selected from a referral center, our study group probably comprised patients with a more severe disease than patients recruited from the general population. On the other hand, the cohort of JIA patients was previously found to have characteristics comparable to those of JIA patients in epidemiological studies[11,19,23]. Our results are limited by the low numbers of PsA patients and the retrospective application of classification criteria and assessment of variables from disease onset. However, since prospective outcome studies will require many years to carry out, retrospective studies may provide important information on the outcome in PsA patients and the ability of the ILAR criteria to identify disease entities with homogenous features.

Patients with juvenile PsA had more physical limitations, as assessed by the SF-36 PCS, than patients with either oligoarthritis or polyarthritis after a median of 23 years and controls at the time of the 15-year followup. Physical limitations, according to the HAQ and the SF-36, worsened from a median of 15 to 23 years in our PsA patients, but not in patients with other JIA subtypes. The magnitude of the change of the HAQ disability indexes in PsA was in the range for clinically important worsening[24]. This result is in accord with the tendency to disease progression found in patients with oligoarticular juvenile PsA[2,8,10]. Although it was statistically significant, one might question whether the

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

Table 6. Clinical and radiographic outcome in patients with juvenile PsA and other subtypes of JIA. Values are number (%) of patients or mean ± standard deviation.

	PsA, n = 31	Oligoarthritis, n = 137	p vs PsA	Polyarthritis, n = 68	p vs PsA	ERA, n = 55	p vs PsA
Variables assessed within first 15 yrs after onset							
Psoriasis confirmed by a dermatologist	12 (39)	0	< 0.001	0	< 0.001	1 (2)	< 0.001
Nail pitting	7 (23)	4 (3)	< 0.001	2 (3)	< 0.001	4 (7)	0.041
Dactylitis	13 (42)	9	< 0.001	2 (3)	< 0.001	3 (6)	< 0.001
Enthesitis	1 (3)	1 (0)	NS	1 (0)	NS	24 (44)	0.001
Positive ANA	10 (32)	51 (37)	NS	19 (28)	NS	7 (13)	0.029
Uveitis	6 (19)	27 (20)	NS	11 (16)	NS	11 (20)	NS
Variables assessed median 15 yrs after onset							
Total cumulative no. of affected joints	12.7 ± 13.2	5.2 ± 6.1	0.004	22.5 ± 13.2	0.001	11.6 ± 12.6	NS
No. of mobility-restricted joints, range 0-68	3.4 ± 8.2	2.3 ± 5.2	NS	9.7 ± 11.6	0.009	4.6 ± 9.0	NS
Remission without medication at least 1 yr	17 (55)	74 (54)	NS	29 (43)	NS	24 (44)	NS
Inactive disease*	20 (65)	93 (70)	NS	32 (47)	NS	27 (49)	NS
Hips, radiographic grade ≥ 2	6 (19)	16 (12)	NS	21 (31)	NS	14 (26)	NS
Ankles, radiographic grade ≥ 2	5 (16)	23 (17)	NS	25 (37)	0.038	12 (22)	NS
Peripheral joints, grade 3–5	7 (23)	18 (13)	NS	31 (46)	0.029	14 (26)	NS
Radiographic sacroiliitis	0	0	NS	0	NS	19 (36)	< 0.001
Using antirheumatic drugs 23 yrs after onset**							
Still on DMARD	8 (29)	9 (8)	0.003	8 (18)	NS	7 (13)	NS
On anti-TNF agents	4 (14)	4 (3)	0.050	4 (9)	NS	3 (8)	NS
On DMARD and/or anti-TNF agents	10 (33)	9 (8)	< 0.001	10 (22)	NS	9 (18)	NS
On NSAID	8 (29)	25 (23)	NS	8 (18)	NS	14 (35)	NS
On prednisolone	4 (14)	2 (2)	0.016	3 (7)	NS	1 (3)	NS

* Remission with or without medication for at least 6 months, ** n = 28 for PsA, n = 40 for ERA, n = 110 for oligoarthritis, n = 45 for polyarthritis. PsA: psoriatic arthritis, ERA: enthesitis related arthritis, NS: not statistically significant, ANA: antinuclear antibodies, DMARD: disease modifying antirheumatic drugs, TNF: tumor necrosis factor, NSAID: nonsteroidal antiinflammatory drugs.

Table 7. Health status after a median of 14.9 years and 22.8 years of disease duration in patients with juvenile PsA, patients with other JIA subtypes, and controls. Values are mean (95% confidence interval).

	PsA	Oligo- or Polyarthritis	p vs PsA	ERA	p vs PsA	Controls	p vs PsA
Disability (HAQ)							
15 yrs after onset	0.21 (0.06–0.36)	0.27 (0.20–0.34)	NS	0.38 (0.23–0.53)	NS		
23 yrs after onset	0.37 (0.18–0.56)	0.27 (0.20–0.34)	NS	0.31 (0.14–0.47)	NS		
p for change over time	0.033	NS		NS			
Health status (SF-36)							
Physical summary score							
15 yrs after onset	49.9 (46.1–53.7)	50.4 (49.1–51.8)	NS	46.4 (42.5–50.3)	NS	54.5 (53.7–55.4)	0.001
23 yrs after onset	46.3 (41.7–50.8)	50.6 (49.0–52.2)	0.045	48.6 (44.6–52.6)	NS		
p for change over time	0.039	NS		NS			
Mental summary score							
15 yrs after onset	52.6 (49.8–55.4)	52.7 (51.4–54.0)	NS	51.2 (48.1–54.4)	NS	49.9 (48.7–51.0)	NS
23 yrs after onset	51.6 (47.0–56.2)	51.2 (49.5–52.8)	NS	47.3 (43.9–50.7)	NS		
Pain*							
15 yrs after onset	2.40 (1.91–2.90)	2.26 (2.08–2.44)	NS	2.88 (2.47–3.30)	NS	2.04 (1.90–2.18)	NS
23 yrs after onset	2.79 (2.26–3.31)	2.27 (2.07–2.48)	0.050	2.85 (2.40–3.30)	NS		

N = 31 for PsA, n = 205 for oligo- or polyarthritis, and n = 55 for ERA at 15 years and n = 28 for PsA, n = 155 for JIA and n = 40 for ERA at 23 years followup. Controls were selected from the general population, matched for sex age and region for the total cohort of JIA patients. * Likert scale, range 1 (no bodily pain) to 6 (very strong bodily pain). PsA: psoriatic arthritis, ERA: enthesitis-related arthritis, HAQ: Health Assessment Questionnaire, range 0 (no disability) to 3 (very severe disability); SF-36: Short Form-36 Health Survey; values < 50 indicate physical or mental health poorer than average. NS: not statistically significant.

change in the SF-36 PCS is clinically significant. The minimal important difference of the SF-36 has not been determined, but the responsiveness seems to be comparable with that of the HAQ in adults with RA[25]. The low frequency of moderate or severe disability in our PsA patients is in agreement with results from Hamilton, *et al* (7% in functional class III or IV), but contrasts with the higher frequency found by Roberton, *et al* (30% in functional class III or

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

IV)[8,9]. The longterm need for treatment with DMARD and/or anti-TNF agents, as associated with PsA in our study, is a marker of disease severity. It cannot be completely ruled out whether skin disease influenced the indication for these drugs in our patients with PsA. However, the substantial need for DMARD is in accord with most previous studies of juvenile PsA[1,8,9].

About half of our PsA patients were in remission after 15 years and 65% had inactive disease. Almost one-fourth had developed joint erosions. The rate of erosive disease was comparable with that found by Southwood, *et al*[2] after a median of 6 years, and lower than the results after 9 years described by Hamilton, *et al*[9]. The frequency of inactive disease has ranged from 34% to 60%[1,2,8,10]. Differences in the definition of remission or inactive disease will have influenced the results. The new criteria for remission in JIA used in our study have not previously been used in PsA[15].

None of our patients with PsA had developed radiographic sacroiliitis or inflammatory back pain even though all patients were radiographically assessed after a median of 15 years. However, 5 patients with psoriasis or a family history of psoriasis in a first-degree relative, including 3 patients with radiographic sacroiliitis, were excluded from the PsA group because of signs of SpA[14]. One-third of the patients that fulfilled the Vancouver but not the ILAR criteria for PsA had radiographic sacroiliitis, and one-fourth had inflammatory back pain. Compared to the Vancouver classification, the ILAR classification restricted the diagnosis of PsA particularly in patients with juvenile SpA. This reduction of numbers of patients available for studies of juvenile PsA may not reflect substantive clinical differences, according to one study[7]. On the other hand, it has been suggested that children with signs of SpA should be included in the ERA group rather than excluded from ERA because of a family history of psoriasis[14]. A low frequency of SpA in juvenile PsA has been found in one study[8]. However, frequencies up to 47% have been described by others[1,2]. Incomplete radiographic assessments and a short disease duration may have influenced the low frequency of SpA found in the first study[8].

Psoriasis in a first-degree relative predicted juvenile PsA with the highest OR in our study. Psoriasis in the patient added independent contribution to the correct classification of PsA patients. These results emphasize the importance of psoriasis in both the patient and a first-degree relative as an inclusion criterion for juvenile PsA[5,8]. Dactylitis at onset was an important determinant for early differentiation of PsA from oligo- or polyarticular JIA in our study, as suggested by others[6,10].

HLA-DRB1*11/12 was increased in patients with PsA compared with controls from the general population and ERA patients in our study. Further, this factor was higher in PsA than in all other JIA subtypes and differentiated PsA from either oligoarthritis or polyarthritis. Ansell, *et al* found an increase of DR5 in 26 patients with juvenile PsA with early onset[3]. An increase of DR5 has also been found in pauciarticular juvenile rheumatoid arthritis, particularly in those with uveitis[26,27]. However, no increase of DR5 was found in 50 juvenile PsA patients studied by Roberton, *et al*[8] and 28 patients studied by Hamilton, *et al*[9]. The ILAR criteria for classification of JIA were applied in our study, while the Vancouver criteria for juvenile PsA were used in previous studies[2,5]. Our study is limited by the small sample size, and further studies from different populations are needed in order to evaluate whether the ILAR criteria identify a group of PsA patients with specific HLA associations.

Toe or ankle arthritis within the first 6 months was a determinant for PsA in our study and PsA was associated with small-joint arthritis in the univariate, but not the multivariate analysis. These results are in line with the previous finding that small-joint disease is more frequent in oligoarticular PsA than in other oligoarticular JIA[6].

We found that onset after age 6 years differentiated PsA from either oligoarthritis or polyarthritis. The mean age of onset was higher than in most previous studies and variations in the results may have been influenced by the different classification criteria used[2,6,8,10]. The presence of psoriasis-like rash is included in the Vancouver but not in the ILAR criteria[2,5]. This may have influenced the higher age at onset in our study, because skin lesions may be more subtle or atypical in younger children[7,28]. On the other hand, exclusion of patients with signs of juvenile SpA according to the ILAR criteria[5] should have decreased the mean age of onset in our patients. One might question whether our PsA group still comprised patients, particularly boys with late-onset disease, that may have had juvenile SpA. However, in addition to the absence of sacroiliitis, there was no increase of HLA-B27, enthesitis, or hip arthritis in our patients with late-onset PsA. Recently it was suggested that juvenile PsA according to the Vancouver criteria comprises 2 distinct populations, one characterized by early onset, female sex, and positive ANA, and another with older patients and a tendency to have axial joint disease[10]. The lack of a peak of girls with early-onset arthritis and a lower frequency of ANA in our PsA patients compared to those previous studies may suggest that the ILAR criteria include fewer girls with early-onset ANA-positive arthritis, a patient group that also may have features in common with early-onset pauciarticular juvenile rheumatoid arthritis[2,6,8,10,26].

Patients with juvenile PsA shared characteristics and genetic markers that were different from other JIA subtypes. Longterm disease progression with worsening of physical limitations was found in patients with PsA, but not in those with other JIA subtypes. However, there was considerable overlap between PsA and other JIA subtypes, particularly regarding joint distribution, remission rates, and the development of joint erosions. Further prospective studies of large patient populations are needed in order to evaluate

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org

whether the ILAR criteria classify a PsA group that represents a relatively homogenous disease entity.

ACKNOWLEDGMENT

The authors thank Dr. Knut Dale and Dr. Virginia Johnson for help with the radiographic examinations.

REFERENCES

1. Shore A, Ansell BM. Juvenile psoriatic arthritis — an analysis of 60 cases. J Pediatr 1982;100:529-35.
2. Southwood TR, Petty RE, Malleson PN, et al. Psoriatic arthritis in children. Arthritis Rheum 1989;32:1007-13.
3. Ansell B, Beeson M, Hall P, Bedford P, Woo P. HLA and juvenile psoriatic arthritis. Br J Rheumatol 1993;32:836-7.
4. Fink CW. Proposal for the development of classification criteria for idiopathic arthritides of childhood. J Rheumatol 1995;22:1566-9.
5. Petty RE, Southwood TR, Manners P, et al. International League of Associations for Rheumatology classification of juvenile idiopathic arthritis: second revision, Edmonton, 2001. J Rheumatol 2004;31:390-2.
6. Huemer C, Malleson PN, Cabral DA, et al. Patterns of joint involvement at onset differentiate oligoarticular juvenile psoriatic arthritis from pauciarticular juvenile rheumatoid arthritis. J Rheumatol 2002;29:1531-5.
7. Stoll ML, Lio P, Sundel RP, Nigrovic PA. Comparison of Vancouver and International League of Associations for Rheumatology classification criteria for juvenile psoriatic arthritis. Arthritis Rheum 2008;59:51-8.
8. Roberton DM, Cabral DA, Malleson PN, Petty RE. Juvenile psoriatic arthritis: Followup and evaluation of diagnostic criteria. J Rheumatol 1996;23:166-70.
9. Hamilton ML, Gladman DD, Shore A, Laxer RM, Silverman ED. Juvenile psoriatic arthritis and HLA antigens. Ann Rheum Dis 1990;49:694-7.
10. Stoll ML, Zurakowski D, Nigrovic LE, Nichols DP, Sundel RP, Nigrovic PA. Patients with juvenile psoriatic arthritis comprise two distinct populations. Arthritis Rheum 2006;54:3564-72.
11. Flato B, Smerdel A, Johnston V, et al. The influence of patient characteristics, disease variables, and HLA alleles on the development of radiographically evident sacroiliitis in juvenile idiopathic arthritis. Arthritis Rheum 2002;46:986-94.
12. Flato B, Lien G, Smerdel A, et al. Prognostic factors in juvenile rheumatoid arthritis: a case-control study revealing early predictors and outcome after 14.9 years. J Rheumatol 2003;30:386-93.
13. Flato B, Hoffmann-Vold AM, Reiff A, Forre O, Lien G, Vinje O. Long-term outcome and prognostic factors in enthesitis-related arthritis: a case-control study. Arthritis Rheum 2006;54:3573-82.
14. Burgos-Vargas R, Rudwaleit M, Sieper J. The place of juvenile onset spondyloarthropathies in the Durban 1997 ILAR classification criteria of juvenile idiopathic arthritis. International League of Associations for Rheumatology. J Rheumatol 2002;29:869-74.
15. Wallace CA, Ruperto N, Giannini E, Childhood Arthritis and Rheumatology Research Alliance, Pediatric Rheumatology International Trials Organization, Pediatric Rheumatology Collaborative Study Group. Preliminary criteria for clinical remission for select categories of juvenile idiopathic arthritis. J Rheumatol 2004;31:2290-4.
16. Ware JE Jr, Kosinski MA. SF-36. Physical and mental summary scales: A manual for users of version 1. Lincoln, Rhode Island: QualityMetric Inc.; 2001.
17. Loge JH, Kaasa S, Hjermstad MJ, Kvien TK. Translation and performance of the Norwegian SF-36 Health Survey in patients with rheumatoid arthritis. I. Data quality, scaling assumptions, reliability, and construct validity. J Clin Epidemiol 1998;51:1069-76.
18. Fries JF, Spitz P, Malleson PN, Holman HR. Measurement of patient outcome in arthritis. Arthritis Rheum 1980;23:137-45.
19. Minden K, Niewerth M, Listing J, et al. Long-term outcome in patients with juvenile idiopathic arthritis. Arthritis Rheum 2002;46:2392-401.
20. Dale K, Paus AC, Laires K. A radiographic classification system in juvenile rheumatoid arthritis applied to the knee. Eur Radiol 1994;4:27-32.
21. Verduyn W, Daxiadis I, Anholts J, et al. Biotinylated DRB sequence-specific oligonucleotides. Comparison to serologic HLA-DR typing of organ donors in eurotransplant. Hum Immunol 1993;37:59-67.
22. Ronningen KS, Spurkland A, Markussen G, Iwe T, Vartdal F, Thorsby E. Distribution of HLA class II alleles among Norwegian Caucasians. Hum Immunol 1990;29:275.
23. Gare BA, Fasth A. Epidemiology of juvenile chronic arthritis in southwestern Sweden: a 5-year prospective population study. Pediatrics 1992;90:950-8.
24. Brunner HI, Klein-Gitelman MS, Miller MJ, et al. Minimal clinically important differences of the Childhood Health Assessment Questionnaire. J Rheumatol 2005;32:150-61.
25. Tugwell P, Idzerda L, Wells GA. Generic quality-of-life assessment in rheumatoid arthritis. Am J Manag Care 2008;14:234.
26. Glass D, Litvin D, Wallace K, et al. Early-onset pauciarticular juvenile rheumatoid arthritis associated with human leukocyte antigen-DRw5, iritis, and antinuclear antibody. J Clin Invest 1980;66:426-9.
27. Fernandez-Vina MA, Fink CW, Stastny P. HLA antigens in juvenile arthritis. Pauciarticular and polyarticular juvenile arthritis are immunogenetically distinct. Arthritis Rheum 1990;33:1787-94.
28. Stoll ML, Nigrovic PA. Subpopulations within juvenile psoriatic arthritis: a review of the literature. Clin Dev Immunol 2006;13:377-80.

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2009. All rights reserved.

Downloaded on April 19, 2024 from www.jrheum.org