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Obesity in psoriatic arthritis

Comparative prevalence and associated factors

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Abstract

Obesity is a common cardiovascular risk factor in psoriatic disease. Although the prevalence of obesity is high, the factors associated with it in patients with psoriatic arthritis (PsA) are poorly understood. We aimed to analyze the frequency and obesity-associated factors in a cohort of PsA.

This retrospective cross-sectional study included 290 consecutive patients with PsA according to CASPAR criteria. Three-hundred ten psoriatic patients without arthritis and 600 outpatients without inflammatory conditions were used as comparison populations. The factors associated with obesity were analyzed first using conditional logistic regression. The significant factors in this first model were introduced in a multivariate model using a backward step approach.

This series included 159 men (54.8%) and 131 women (45.2%), with an average age of 54 ± 12 years. Obesity was more common both in psoriasis (36.5% vs 22%, OR 2.1 [95%CI: 1.5–2.8), $P < .01$]) and PsA (27.6% vs 22%, OR 1.4 [95%CI: 1.0–1.9], $P < .05$) than in the non-inflammatory population. Obesity was more frequent in psoriasis (36.5%) than in PsA (27.6%), OR 1.5 95% CI: 1.1 to 2.1, $P < .05$. After correcting for age, sex, disease duration, and other confounders, independent associations with obesity ($P < .05$) were: PsA family history (OR 3.6, 95%CI: 1.1–12.4), evolution as axial disease (OR 4.4, 95%CI: 1.0–15.4), and dyslipidemia (OR 3.5, 95% CI: 1.5–8.6).

Obesity is common in psoriatic disease, but much more frequent among patients with cutaneous than joint disease. Patients who present with spondylitis during evolution are more prone to this comorbidity, and therefore, should be closely monitored to correct this eventuality in a timely manner.

Abbreviations: ASAS = Assessment of SpondyloArthritis international Society, axSpA = Axial Spondyloarthritis, BMI = body mass index, BSA = body surface area, CASPAR = ClASsification criteria for psoriatic arthritis, CI = confidence interval, CRP = C-reactive protein, CVD = cardiovascular disease, CVRFs = cardiovascular risk factors, DAS = disease activity score, DM = diabetes mellitus, DMARDs = disease-modifying antirheumatic drugs, ENPE = Nutritional Study of the Spanish Population, EULAR = European League Against Rheumatism, HLA = human leukocyte antigen, HUCA = Hospital Universitario Central de Asturias, IL = Interleukin, NSAID = non-steroidal antiinflammatory drugs, OR = odds ratio, PASI = psoriasis area and severity index, PsA = psoriatic arthritis, Th = T-helper, TNFα = tumor necrosis factor-α.

Keywords: axial disease, comorbidities, obesity, psoriasis, psoriatic arthritis

1. Introduction

Psoriatic arthritis (PsA) is a chronic inflammatory musculoskeletal disease, usually seronegative for rheumatoid factor, associated with psoriasis, with a prevalence of 0.02–0.42% in the general population, and 13.8–30% among patients with psoriasis.[1] Psoriatic arthritis is a heterogeneous condition with articular and extra-articular manifestations including a combination of peripheral arthritis, spondylitis, enthesitis, dactylitis, and skin/nail disease.

Cutaneous psoriasis and PsA are the most important poles of what is now regarded as psoriatic disease. This term refers to a systemic entity that goes beyond the skin and joints to encompass other aspects, such as osteoporosis, ocular inflammation, intestinal inflammation, liver disease, and, above all, cardiovascular comorbidity.[2]

The association between psoriatic disease and obesity has been well established in the past decade. Thus, several observational and epidemiological studies have confirmed a higher prevalence and incidence of obesity (and other components of the metabolic syndrome) in patients with psoriatic disease.[2–6] However, the exact nature of this relationship is not well understood and we can even speculate if overweight and obesity, rather than comorbidities, are intrinsic traits of the psoriatic disease itself. It is also unclear whether obesity is more prevalent in psoriasis, or if, on the contrary, joint involvement contributes to increasing its prevalence in psoriatic patients.[6] Currently, psoriatic disease is regarded as an immunological disease with an altered IL-17 signaling pathway.[7,8] In that sense, obesity has been shown to promote the expansion of IL-17-producing T cells in adipose and

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peripheral tissues. Accordingly, a significant increase in circulating IL-17 and IL-23 cytokines has also been observed in obese compared with lean individuals.[8] One of the recent hypotheses between IL-17 and atheromatosis, suggests that IL-17 released from visceral adiposity would induce an increased expression of eotaxin by the smooth muscle cells of the vascular wall, and this in turn would be related to a greater carotid intima-media thickness (early atheromatosis).[9]

Obesity is not only important as a CVRF that contributes to a higher prevalence of cardiovascular disease in the general population as well as in patients with psoriasis and PsA, but it is also associated with lower retention and response rates to disease-modifying antirheumatic drugs (DMARDs).[10] Furthermore, some experiences have shown that weight reduction in PsA is associated with an increased likelihood of minimal disease activity in patients treated with anti-TNFα therapy.[11]

Optimal care of patients with PsA means not only treating the skin and joint disease, but also identifying comorbidities and ensuring that these comorbidities are appropriately addressed.[12] Much work remains in understanding the complex relationship between PsA and cardiometabolic comorbidities. In this sense, it is of paramount importance to analyze what factors of the disease may be associated with the presence of these comorbidities, and whether the therapeutic interventions aimed at improving the inflammation of the disease have some positive influence on them.

We aimed to evaluate the prevalence of obesity and the factors associated with it in a cohort of PsA seen at a referral center.

2. Patients and methods

This retrospective cross-sectional study included 290 consecutive patients treated at a single university hospital who fulfilled the ClASsification for Psoriatic ARthritis (CASPAR) criteria for PsA.[13] These patients were managed according to a standard protocol in a monographic PsA clinic within the rheumatology department of a tertiary care hospital. Patients of this cohort were regularly evaluated every three to six months depending on the disease activity or severity. Patients were informed about the objectives of the study, and informed consent forms were signed by all participants. This study was conducted following the rules of good clinical practice (Helsinki Declaration). The study was approved by the Clinical Research Ethics Committee of Hospital Universitario Central de Asturias (reference No. HUCA 68/16). Patient anonymity and confidentiality of data has been preserved throughout the study. The study period was limited to the years 2012–2017. The study protocol has been published elsewhere.[14]

2.1. Study population and study variables

The cohort was composed of 159 men and 131 women with a mean age of 54 ± 12 years (age range: 24–82). Mean disease follow up of 7.2 ± 6.6 years. We described the joint patterns, both at the beginning of the disease (6 first months), and during the evolution, according to the following: patients with four or less swollen joints were labeled as having oligoarthritis; those who presented with five or more were tagged under the polyarthritis category. Patients with axial disease were classified according to the Assessment of SpondyloArthritis international Society (ASAS) criteria for axial spondyloarthritis.[15] Patients were stratified in early and late onset disease according to a cut-off point of 40 years.

Family history of psoriasis and PsA was collected. Educational levels were assessed and classified under three categories according to the achieved degree: primary, secondary (high-school), and university studies. Data regarding skin disease included the main type of psoriasis, the location of lesions, nail disease, and the percentage of patients with the involvement of three or more body areas. All cases of psoriasis were confirmed by a dermatologist. The onset patterns of arthritis were based on the main articular phenotype during the first 6 months of disease evolution. Pelvic, lumbar, and cervical lateral x-rays were included in the radiographic study to assess spinal involvement. X-rays of the affected areas during follow-up were also obtained. Laboratory data included the following routine tests: blood and urine biochemistry, blood count, erythrocyte sedimentation rate, human leukocyte antigen (HLA)-B*27, HLA-C*06, rheumatoid factor, antinuclear antibodies, and C-reactive protein (CRP). Glucocorticoid, NSAID, and conventional as well as biologic DMARD use was also collected.

2.2. Definition of CVRFs

- Diabetes mellitus (DM): defined by analytical findings during the monitoring of glucose elevation of more than 126 mg/dL on two fasting determinations, chronic treatment with antidiabetic or insulin, or diagnosed by an endocrinologist. Type I diabetes patients were not included in this study.
- High blood pressure (hypertension): Defined as finding at least two determinations on different days of blood pressure greater than 140/90 mmHg during follow-up, the chronic use of antihypertensive treatment, or diagnosis by a medical specialist.
- Dyslipidemia: Defined as the ongoing finding of cholesterol figures above 200 mg/dL or triglycerides figures above 150 mg/dL during follow-up, chronic treatment with lipid-lowering drugs, or diagnosis by a medical specialist.
- Obesity: Defined as the presence of a body mass index (BMI) equal or greater than 30 kg/m^2, whereas overweight is defined as a BMI between 25 and 29.9 kg/m^2.
- Smoking habit: Active smokers are all daily smoker patients at the time of the study (irrespective of the number of cigarettes); those with a history of smoking (at least five years), but who were not active smokers at the time of the study, are regarded as former smokers.

2.3. Statistical analysis

A descriptive statistical analysis of all the variables was performed, including central tendency and dispersion measures for continuous variables, and absolute and relative frequencies for categorical variables. The differences between quantitative variables with normal distribution according to the Kolmogorov–Smirnoff test were analyzed by the Student's *t*-test. Differences between quantitative non-normal variables were studied by non-parametric tests (Mann–Whitney *U* test, or Kruskall–Wallis *H* test). Pearson's chi-square or Fisher exact test was used for qualitative variables. The frequency of obesity was compared to that of 310 long-lasting skin psoriasis patients (22 ± 11 years) without arthritis and with 600 non-inflammatory outpatients. Both comparison populations were chosen at random from the departments of rheumatology and dermatology. The non-inflammatory population was composed of patients

with non-inflammatory rheumatic processes (osteoarthritis, fibromyalgia, soft tissue rheumatism, non-specific chronic low back pain, etc) and subjects with non-inflammatory skin conditions. Patients with psoriasis had, on average, more than 10 years of evolution, which is the average time that elapses between the onset of psoriasis and the onset of arthritis. Both comparative populations were matched by age (± 3 years) and sex (1:1) with the study population. Odds ratio (OR) values with a 95% CI were calculated by conditional logistic regression analysis. Initially, a univariate analysis was performed to examine unadjusted associations of obesity with its potential risk factors. The factors introduced in the univariate model were: age, sex, disease duration, disease family history, onset of psoriasis after 40 years, onset of arthritis above 40 years, patterns of presentation of arthritis, evolutive patterns of arthritis, extension of psoriasis, nail involvement, dactylitis, enthesitis, erosive disease, use of NSAIDs, use of glucocorticoids, use of DMARDs (biological and non-biological), duration of systemic treatment, CVRF, as well as CV outcomes. Significant variables in the univariate analysis ($P < .10$) were then introduced in a multivariate analysis with a backward stepwise approach. Tests were two-tailed with a significance level of 5%. Data were analyzed using SPSS V19.0 statistical software (IBM Corp. NY, USA)

3. Results

This series included 159 men (54.8%) and 131 women (45.2%), with an average age of 54 ± 12 years. The average age of onset of psoriasis was 32 ± 16 years, while the average age of onset of arthritis was 46 ± 14 years. Most patients suffered from common or plaque psoriasis (86.2%). Nail psoriasis was detected in 122 patients (42.1%). One hundred and thirty patients presented with psoriasis in three or more body areas. Forty-five percent had a family history of psoriasis, while 15.2% had a family history of PsA. The most common form of PsA was the oligoarticular form (42.1%), while 20% of this series had erosive disease. Fifty-two patients were HLA-B*27 positive, and 38.3% expressed the HLA-C*06 allele. Table 1 shows the main clinical-demographic characteristics of this series.

The frequency of traditional CVRFs among PsA patients was as follows: diabetes 12%, hypertension 29%, dyslipidemia 28%, obesity 27.6%, and tobacco use 27.2%. Hypertension (29% vs 18%, OR 1.7 95% CI: 1.25–2.50, $P < .01$) and dyslipidemia (28% vs 13.5%, OR 2.5 95%CI: 1.7–3.3, $P < .01$) were more common in PsA than in psoriasis alone. However, obesity (36.5% vs. 27.6%, OR 1.5 95%CI: 1.1–2.1, $P < .05$) and tobacco use (34.5% vs 27.2%, OR 1.4 95%CI: 1.0–2.0, $P < .05$) were more prevalent among psoriasis than in PsA. Obesity was more common both in psoriasis (36.5% vs 22%, OR 2.1 95%CI: 1.5–2.8, $P < .01$) and PsA (27.6% vs 22%, OR 1.4 95%CI: 1.0–1.9, $P < .05$) than in the non-inflammatory population. Diabetes prevalence was higher among PsA (12%), but this was not statistically different from that found in psoriasis (8.7%). Table 2 represents the distribution of CVRFs in the three populations.

Factors associated with obesity in univariate analysis ($P < .10$) were age ≥ 50 years, an onset of psoriasis > 40 years (OR 2.4), an onset of arthritis > 40 years (OR 2.1), a PsA family history (OR 3.1), a polyarticular onset (OR 1.9), an axial onset (OR 2.5), polyarticular evolution (OR 2.4), axial evolution (OR 4.2), diabetes (OR 3.6), hypertension (OR 3.9), and dyslipidemia (OR 3.5). Independent associations with obesity found in the multivariate model ($P < .05$) were a PsA family history (OR 3.6, 95%CI: 1.1–12.4), axial evolution (OR 4.4, 95%CI: 1.0–15.4), and dyslipidemia (OR 3.5, 95%CI: 1.5–8.6). Table 3 shows the uni and multivariate model of this study.

Table 1

Disease characteristics of the study populations.

Variable	PsA n: 290	Psoriasis n: 310	NI population n: 600
Age (year ± SD)	54 ± 12	53 ± 11.5	55 ± 12.4
Age at psoriasis onset (year ± SD)	32 ± 16	31 ± 14.2	
Age at arthritis onset (year ±SD)	46 ± 14		
Duration of psoriasis (year ± SD)	21 ± 10	22 ± 11	
Duration of arthritis (year ± SD)	11 ± 7.2		
Men (n, %)	159 (54.8)	164 (52.9)	318 (53)
Education level:			
Primary (n, %)	145 (50)	148 (47.7)	270 (45)
Secondary (n, %)	79 (27.2)	87 (28.1)	180 (30)
Academic (n, %)	66 (22.8)	235 (24.2)	150 (25)
Plaque psoriasis (n, %)	250 (86.2)	272 (87.7)	
Nail disease (n, %)	122 (42.1)	110 (35.5)	
Psoriasis in ≥ 3 body areas (n, %)	130 (45)	155 (50)	
Family history of psoriasis (n, %)	130 (45)	136 (44)	12 (2)
Family history of PsA (n, %)	44 (15.2)	15 (4.8)	5 (0.8)
Oligoarthritis as onset (n, %)	174 (60)		
Polyarthritis as onset (n, %)	81 (28)		
Axial disease as onset (n, %)	35 (12)		
Oligoarthritis during evolution (n, %)	122 (42.1)		
Polyarthritis during evolution (n, %)	81 (28)		
Axial disease during evolution (n, %)	17 (5.8)		
Mixed pattern during evolution (n, %)	70 (24.1)		
Dactylitis (n, %)	87 (30)		
DIP joint disease (n, %)	72 (24.8)		
Mutilating arthritis (n, %)	5 (1.7)		
Erosive disease (n, %)	58 (20)		
HAQ (mean ± SD)	0.74 ± 0.32		
BASDAI (mean ± SD)	3.64 ± 2.12		
Pain VAS (mean ± SD)	4.09 ± 2.64		
DAS28 (mean ± SD)	3.82 ± 3.21		
HLA-B*27 (n, %)	52 (17.9)		
HLA-C*06 (n, %)	112 (38.6)	124 (40)	
NSAIDs (n, %)	72 (24.8)	47 (15.2)	420 (70)
Glucocorticoids (n, %)	34 (11.7)	15 (4.8)	60 (10)
MTX (n, %)	189 (65.2)	128 (41.3)	
Biologics (n, %)	128 (44.1)	132 (42.6)	

BASDAI = Bath Ankylosing Spondylitis Disease Activity Index, DAS = disease activity score, DIP = distal interphalangeal, HAQ = Health Assessment Questionnaire, HLA = human leukocyte antigen, MTX = methotrexate, NI = non-inflammatory, NSAIDs = non-steroidal antiinflammatory drugs, PsA = psoriatic arthritis, VAS = visual analog scale.

4. Discussion

We have shown a high prevalence of obesity in patients with psoriatic disease. However, this comorbidity was much more prevalent among subjects with psoriasis than in those with arthritis. When analyzing the prevalence of CVRFs in psoriatic disease, we verified a differential distribution. Thus, hypertension and dyslipidemia were more common in patients with arthritis, while other CVRFs, such as smoking or obesity itself, were more prevalent in patients with psoriasis without arthritis. Taken together, some CVRFs were clearly more prevalent in patients with psoriatic disease than in the non-inflammatory population, confirming earlier findings.[2–6,8] In that line, the stratification of psoriatic disease according to the age of onset of symptoms or

Table 2

Distribution of cardiovascular risk factors among the study populations.

CVRF	Psoriasis n:310	PsA n: 290	Non-inflammatory controls n: 600
Hypertension	56 (18%)	84 (29%)	138 (23%)
Dyslipidemia	42 (13.5%)	81 (28%)	198 (33%)
Diabetes	27 (8.7%)	35 (12%)	30 (5%)
Obesity	113 (36.5%)	80 (27.6%)	132 (22%)
Tobacco use	107 (34.5%)	79 (27.2%)	126 (21%)
	Psoriasis vs Ni controls OR (95%CI); *P*-values	**Psoriasis vs PsA OR (95%CI); *P*-values**	**PsA vs Ni controls OR (95%CI); *P*-values**
Hypertension	0.7 (0.5–1.0); .08	0.6 (0.4–0.8); .003	1.3 (1.0–1.8); .045
Dyslipidemia	0.3 (0.2–0.5); <.0001	0.4 (0.3–0.6); <.0001	0.8 (0.6–1.1); .1
Diabetes	1.8 (1.1–3.0); .02	0.7 (0.4–1.2); .2	2.6 (1.6–4.2); .0002
Obesity	2.1 (1.5–2.8); <.0005	1.5 (1.1–2.1); .02	1.4 (1.0–1.9); .045
Tobacco use	2.0 (1.5–2.7); <.0005	1.4 (1.0–2.0); .045	1.4 (1.0–1.9); .040

CI = confidence interval, CVRF = CardioVascular Risk Factors, Ni = non-inflammatory, OR = odds ratio, PsA = psoriatic arthritis.

depending on the presence of arthritis has helped to better define the cardiovascular phenotype of this entity. For example, most classic CVRFs tend to occur in subjects with onset of psoriasis or arthritis above 40 years. However, when the age factor is corrected in regression analysis models, psoriasis itself, or arthritis, continue to contribute differentially to the presence of these factors. In fact, our group has found a clear association between hypertension and arthritis of onset above 40 years, and between diabetes and psoriasis above that age limit. These findings reinforce the notion that psoriatic disease per se contributes to the increase of CV risk over the age factor and other classic CVRFs.[14]

The prevalence figures for obesity in our study population are clearly higher than the frequency of obesity in the general population of our country. Data taken from the ENPE study (Spanish acronym for the Nutritional Study of the Spanish Population), a cross-sectional observational study designed to collect recent data on consumer dietary habits, anthropometric data, and physical activity in the noninstitutionalized Spanish population older than 3 years, revealed a prevalence of obesity of 21.6% in the Spanish adult population aged 25 to 64 years.[16] This latter figure was quite similar to that of our non-inflammatory patients.

Our results confirm the higher prevalence of traditional CVRFs pointed out by epidemiological studies over the last decade. However, the aforementioned differential distribution of some of them, depending on the presence or absence of arthritis, is striking. It has been speculated that the higher inflammatory load associated with the arthritic component of psoriatic disease would be related to a higher frequency of diabetes and hypertension in these subjects.[8,17,18] Indeed, we have confirmed a higher frequency of hypertension (statistically significant) and diabetes (without statistical significance) in patients with arthritis. Data on the frequency of obesity in psoriatic disease show different results; in some studies this frequency is higher and in others it is lower, depending on the presence or absence of associated arthritis.[2,7,8,19] The greater frequency of obesity, and at the same time, the lower prevalence of dyslipidemia seen in psoriasis compared to non-inflammatory and arthritic populations, may be discordant. One potential explanation is that inflammatory states can be inversely associated with serum lipid levels, and thus in more inflammatory phases these levels can be falsely lowered (lipid paradox).[20]

Adipose tissue has ceased to be a mere reservoir of energy and has become a metabolically active tissue with the production, among other substances, of proinflammatory cytokines.[21] Visceral obesity and insulin resistance, which are common findings in psoriatic disease, are characterized by the persistent production of abnormal adipocytokines such as TNF, IL-6, IL-1, leptin, and adiponectin, which contribute to the development of a

Table 3

Uni and multivariate model of this study.

Variable	Univariate model OR (95%CI)	*P* value	Multivariate model OR (95%CI)	*P* value
Age ≥ 50 yr	4.6 (1.5–11.3)	<.01		
Age of onset of psoriasis > 40 yr	2.4 (1.1–5.5)	<.01		
Age of onset of arthritis > 40 yr	2.1 (1.1–4.4)	<.05		
PsA family history	3.9 (1.1–10.2)	<.05	3.6 (1.1–12.4)	<.01
Polyarticular onset	1.9 (1.0–4.0)	<.05		
Polyarticular evolution	2.4 (1.1–5.0)	<.05		
Axial onset	2.5 (1.0–7.3)	<.01		
Axial evolution	4.2 (1.4–17.7)	<.01	4.4 (1.0–15.4)	<.01
Diabetes	3.6 (1.3–9.9)	<.01		
Hypertension	3.9 (1.8–8.3)	<.01		
Dyslipidemia	3.5 (1.6–7.7)	<.01	3.5 (1.5–8.6)	<.01

PsA = psoriatic arthritis, yr = years.

pro-inflammatory state and further a chronic, subclinical vascular inflammation that modulates and results in atherosclerotic processes.[8,9,21,22] The role of Th17-derived cytokines in the pathogenesis of obesity and related inflammatory diseases is increasingly recognized. Supporting the implication of IL-17 in the metabolic syndrome, the levels of IL-17R expression in the liver or muscles have been shown to correlate with insulin resistance, and IL-17 blocking has resulted in the decrease of hepatic inflammation in the non-alcoholic steatohepatitis syndrome.[8,23] These findings demonstrate the close relationships between obesity and inflammation in IL-17-mediated diseases, such as PsA.

To date, studies on the specific factors of the inflammatory diseases linked to the risk of obesity are very scarce.[17,19,24] In this study, we were able to verify that the best multivariate model to explain the obesity of our cases combines genetic factors (a family history of PsA), with elements of the metabolic syndrome (dyslipidemia) and other factors specific to the arthritic process. Thus, axial involvement was associated with obesity. However, axial onset was not related to obesity in the multivariate model. It seems, therefore, that it is the evolution towards a spondylitis pattern (isolated or mixed) that contributes to this risk. It is possible that patients with spinal and pelvic involvement (spondylitis) may see their mobility restricted in a clearer way than those with less limiting forms of joint disease. In fact, most patients with axial involvement in this study also had peripheral disease, so perhaps they suffered from a more aggressive form of arthritis. This lead us to consider whether these patients were more likely to also suffer from obesity due to having a greater inflammatory load, or if, on the contrary, their mobility was more severely limited, they adopted a more sedentary lifestyle and, therefore, were more prone to overweight and obesity.

Obesity is more common in axial spondyloarthritis (axSpA) than in the general population. Obese patients had significantly higher disease activity, worse physical function, and worse QoL than overweight and normal weight patients, in axSpA.[25] Nevertheless, the relationships between obesity and PsA are more complex. Obesity has been linked with late-onset psoriasis and PsA, while normal weight is associated with the presence of the HLA-B*27 allele and an earlier onset of the disease. In patients who are HLA-B*27-negative, the association between obesity and PsA is statistically significant, but obesity is less frequent in patients with PsA who are HLA-B*27-positive.[26]

It is important to note that both obesity and tobacco use, which were more prevalent among psoriatic disease patients, are now understood as bi-directionally associated factors with the disease (cause and consequence).[2] Accordingly, several prospective studies seem to indicate that both may be risk factors for psoriasis and PsA.[27,28] Unfortunately, due to the cross-sectional nature of our study, it is impossible to infer a causal association in that regard.

This study has the limitations of a cross-sectional study, so it is difficult to discern the direction of the associations found in it. Also, due to the cross-sectional and retrospective nature of this study, important factors that could influence the appearance of obesity such as the average and cumulative dose of steroids, dietary habits, or the presence of certain comorbidities and their treatments (e.g., depression) have not been taken into account in the final analysis. Nor have we taken into consideration inflammatory analytical parameters, such as CRP which seem to be related to the presence of certain CVRFs, such as obesity.[29] As regards to this latter point, elevated levels of several inflammatory mediators have been found in subjects with atherosclerosis. Increased basal levels of cytokines, cell adhesion molecules, selectins, high sensitive CRP, fibrinogen, and serum amyloid A are related to an increased risk of cardiovascular events.[29] In that sense, several studies have suggested the potential prognostic value of a variety of inflammatory markers, but regrettably, their overall clinical predictive value is modestly incremental at best, especially for individual subjects compared to groups of patients.[29]

Despite the limitations outlined above, yet, we have collected the study variables in a standardized manner and according to a strict study protocol, and, in addition, some of our results are in line with those of most recent meta-analyses,[30] supporting their consistency.

The concept of a common pathogenic mechanism for atherosclerosis and systemic rheumatic diseases has resulted in the increasing importance of a multidisciplinary integrated approach to optimize screening and therapy for patients with PsA and its comorbidities, with active coordination between different specialists as well as primary care colleagues. This comprehensive multidisciplinary view should be the basis for a better global prognosis of the disease and its complications.[31]

5. Conclusions

We have found that obesity is frequent in psoriatic disease, but even more so in the population with psoriasis alone. This risk should be especially evaluated in patients with axial forms of PsA, focusing the most effective anti-inflammatory therapies for this group so that their physical function could be preserved in the best possible way. Likewise, patients with PsA should be encouraged to maintain healthy lifestyle habits.

Author contributions

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References

[1] Ogdie A, Weiss P. The epidemiology of psoriatic arthritis. Rheum Dis Clin North Am 2015;41:545–68.
[2] Husni ME. Comorbidities in psoriatic arthritis. Rheum Dis Clin North Am 2015;41:677–98.
[3] Yim KM, Armstrong AW. Updates on cardiovascular comorbidities associated with psoriatic diseases: epidemiology and mechanisms. Rheumatol Int 2017;37:97–105.
[4] Ogdie A, Yu Y, Haynes K, et al. Risk of major cardiovascular events in patients with psoriatic arthritis, psoriasis and rheumatoid arthritis: a population-based cohort study. Ann Rheum Dis 2015;74:326–32.
[5] Han C, Robinson DWJr, Hackett MV, et al. Cardiovascular disease and risk factors in patients with rheumatoid arthritis, psoriatic arthritis, and ankylosing spondylitis. J Rheumatol 2006;33:2167–72.

[6] Jensen P, Skov L. Psoriasis and obesity. Dermatology 2016;232:633–9.
[7] Conrad C, Gilliet M. Psoriasis: from pathogenesis to targeted therapies. Clin Rev Allergy Immunol 2018;54:102–13.
[8] Puig L. Cardiometabolic comorbidities in psoriasis and psoriatic arthritis. Int J Mol Sci 2018;19:58doi:10.3390/ijms19010058.
[9] Tarantino G, Costantini S, Finelli C, et al. Is serum Interleukin-17 associated with early atherosclerosis in obese patients? J Transl Med 2014;12:214.
[10] Galíndez E, Carmona L. Is obesity in psoriatic arthritis associated with a poorer therapeutic response and more adverse effects of treatment with an anchor drug? Reumatol Clin 2016;12:307–12.
[11] Almodóvar R, Zarco P, Otón T, et al. Effect of weight loss on activity in psoriatic arthritis: a systematic review. Reumatol Clin 2017;doi: 10.1016/j.reuma.2017.01.010.
[12] Agca R, Heslinga SC, Rollefstad S, et al. EULAR recommendations for cardiovascular disease risk management in patients with rheumatoid arthritis and other forms of inflammatory joint disorders: 2015/2016 update. Ann Rheum Dis 2017;76:17–28.
[13] Taylor W, Gladman D, Helliwell P, et al. Classification criteria for psoriatic arthritis: development of new criteria from a large international study. Arthritis Rheum 2006;54:2665–73.
[14] Alonso S, Tejón P, Sarasqueta C, et al. Age at disease onset may help to further characterize the disease phenotype in psoriatic arthritis. Joint Bone Spine 2016;83:533–7.
[15] Rudwaleit M, van der Heijde D, Landewé R, et al. The development of Assessment of SpondyloArthritis international Society classification criteria for axial spondyloarthritis (part II): validation and final selection. Ann Rheum Dis 2009;68:777–83.
[16] Aranceta-Bartrina J, Pérez-Rodrigo C, Alberdi-Aresti G, et al. Prevalence of general obesity and abdominal obesity in the Spanish adult population (aged 25-64 years) 2014-2015: the ENPE study. Rev Esp Cardiol (Engl Ed) 2016;69:579–87.
[17] Husted JA, Thavaneswaran A, Chandran V, et al. Cardiovascular and other comorbidities in patients with psoriatic arthritis: a comparison with patients with psoriasis. Arthritis Care Res 2011;63:1729–35.
[18] Coto-Segura P, Eiris-Salvado N, González-Lara L, et al. Psoriasis, psoriatic arthritis and type 2 diabetes mellitus: a systematic review and meta-analysis. Br J Dermatol 2013;169:783–93.
[19] Maglio C, Peltonen M, Rudin A, et al. Bariatric surgery and the incidence of psoriasis and psoriatic arthritis in the Swedish Obese Subjects Study. Obesity (Silver Spring) 2017;25:2068–73.
[20] McGrath CM, Young SP. Lipid and metabolic changes in rheumatoid arthritis. Curr Rheumatol Rep 2015;17:57.
[21] Eder L, Gladman DD. Atherosclerosis in psoriatic disease: latest evidence and clinical implications. Ther Adv Musculoskelet Dis 2015;7:187–95.
[22] Chehimi M, Vidal H, Eljaafari A. Pathogenic role of IL-17-producing immune cells in obesity, and related inflammatory diseases. J Clin Med 2017;6:
[23] McLaughlin T, Liu LF, Lamendola C, et al. T-cell profile in adipose tissue is associated with insulin resistance and systemic inflammation in humans. Arterioscler Thromb Vasc Biol 2014;34:2637–43.
[24] Castañeda S, Martín-Martínez MA, González-Juanatey C, et al. Cardiovascular morbidity and associated risk factors in Spanish patients with chronic inflammatory rheumatic diseases attending rheumatology clinics: baseline data of the CARMA Project. Semin Arthritis Rheum 2015;44:618–26.
[25] Maas F, Arends S, van der Veer E, et al. Obesity is common in axial spondyloarthritis and is associated with poor clinical outcome. J Rheumatol 2016;43:383–7.
[26] Eder L, Abji F, Rosen CF, et al. The association between obesity and clinical features of psoriatic arthritis: a case-control study. J Rheumatol 2017;44:437–43.
[27] Ogdie A, Gelfand JM. Clinical risk factors for the development of psoriatic arthritis among patients with psoriasis: a review of available evidence. Curr Rheumatol Rep 2015;17:64.
[28] Nguyen UDT, Zhang Y, Lu N, et al. Smoking paradox in the development of psoriatic arthritis among patients with psoriasis: a population-based study. Ann Rheum Dis 2018;77:119–23.
[29] Shah PK. Biomarkers of plaque instability. Curr Cardiol Rep 2014;16:547.
[30] Horreau C, Pouplard C, Brenaut E, et al. Cardiovascular morbidity and mortality in psoriasis and psoriatic arthritis: a systematic literature review. JEADV 2013;27(Suppl. 3):12–29.
[31] Queiro R, Coto P. Multidisciplinary care for psoriatic disease: where we are and where we need to go. Rheumatology (Oxford) 2017;56:1829–31.