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Comorbidities in pediatric psoriasis patients: A retrospective single-center study

Pediatrik psoriazis hastalarında komorbiditeler: Tek merkezli retrospektif çalışma

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Abstract

Background and Design: This study aimed to investigate the effects of the comorbidities on disease severity and outcomes in pediatric psoriasis patients.
Materials and Methods: A total of 366 patients enrolled to the study were ≤18 years old and were followed up between January 2013 and December 2017. Age, gender, family history, localization, clinical type, severity, treatments, duration of treatment/response, and comorbidities were retrieved retrospectively. Physician Global Assessment was used for psoriasis severity. All parameters were compared statistically in between groups that patients with or without comorbidities. Statistical significance was accepted p<0.05.
Results: Of the 366 patients 62.6% were women, and 37.4% were men. At least one comorbidity was detected in 39.3% of the patients. The most common observed comorbidity was allergic rhinitis (8.1%), and obesity (7.1%) was the second most common. The duration of treatment was higher in patients with comorbidity than in patients without comorbidities, and the duration of the disease was statistically significant (p=0.043). Scalp, face, nail, and palmoplantar involvement was more common in patients with comorbidity than in patients without comorbidity (p>0.05). Those with comorbidity were generally higher in patients with moderate to severe psoriasis (p=0.165). In patients with epilepsy, asthma, allergic rhinitis, and valvular disorders, the clinical manifestation was mild. Biological agent use is statistically higher in comorbidity group (p=0.045). It was found that the rates of complete and partial remission rates were lower, and relapse was higher in the comorbidity group, but this was not statistically significant.
Conclusion: In this study, a significant relationship was found between comorbidity and disease duration (p=0.043). Comorbidities in cases of moderate to severe psoriasis and accompanying cases. Our results are compatible with previous literature, which indicates that the key to managing pediatric psoriasis is investigation and recognition of comorbidities.
Keywords: Psoriasis, pediatric, comorbidity

Öz

Amaç: Pediatrik psoriazis bazı komorbiditerle ilişkilendirilmiştir. Çalışmamızda pediatrik psoriazis hastalarında komorbiditelerin varlığının psoriazis kliniği ve şiddeti, tedavi seçimi ve tedaviye yanıt üzerine etkilerinin araştırılması amaçlandı.
Gereç ve Yöntem: Çalışmaya Ocak 2013-Aralık 2017 tarihleri arasında 18 yaş ve altı toplam 366 hasta dahil edildi. Hastaların yaşı, cinsiyeti, aile öyküsü, lokalizasyonu, klinik tipi, klinik şiddeti, tedaviler, tedavi süreleri/yanıtları retrospektif olarak incelendi. İstatistiksel anlamlılık p<0,05 olarak kabul edildi.
Bulgular: Üç yüz altmış altı hastanın %62,6'sı kız, %37,4'ü erkek idi. Hastaların %39,3'ünde en az bir komorbidite saptandı. Komorbiditeler arasında en sık alerjik rinit (%8,1), ikinci sıklıkta obezite (%7,1) görülmekte idi. Komorbidite olanlarda hastalık süresi, istatistiksel olarak anlamlı olacak şekilde daha uzun bulundu (p=0,043). Saçlı deri, yüz, tırnak ve palmoplantar tutulum komorbidite olan grupta olmayanlara göre daha yüksek oranda idi (p>0,05). Şiddetli ve orta şiddetli psoriazis hastalarında, daha yüksek oranda komorbidite görülmekte idi (p=0,165). Epilepsi,

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astım, alerjik rinit, valvüler bozukluk olanlarda klinik hafif şiddette görülmekte idi. Biyolojik ajan kullanımı komorbiditesi olan grupta istatistiksel olarak daha yüksek görüldü (p=0,045). Komorbidite olan grupta olmayan gruba göre tam remisyon ve kısmi remisyon oranlarının daha az, relaps oranlarının daha fazla olduğu saptandı ama istatistiksel olarak anlamlı değildi.
Sonuç: Bu çalışmada komorbidite ile hastalık süresi arasında anlamlı bir ilişki bulundu (p=0,043). Komorbiditeler, orta ile şiddetli psoriazis hastalığı eşlik eden olgularda daydı. Sonuçlarımız, pediatrik psoriazis yönetiminde komorbiditelerin araştırılması ve tanınmasının esas olduğu önceki literatürle uyumludur.
Anahtar Kelimeler: Psoriazis, pediatri, komorbidite

Introduction

Psoriasis is a chronic inflammatory disease that can affect people of any age and is characterized by sharply demarcated erythematous scaly papules and plaques. Due to the common pathogenesis during psoriasis, metabolic syndrome, insulin resistance, hypertension, obesity, hyperlipidemia, diabetes, cardiovascular disease, psychological/psychiatric disorders, inflammatory bowel disease, rheumatoid arthritis, vitiligo, alopecia areata, and psychosocial diseases accompany and can affect each other's occurrence and clinical course. For this reason, psoriasis is currently considered not only as a skin disease but as a systemic inflammatory disease. Some authors[1-5] believe that the term "psoriatic disease" would be more appropriate to describe the disease. Comorbidities are more common in patients with moderate psoriasis due to increased inflammatory effect and common pathogenesis. In studies, the rate of comorbidity in patients with psoriasis under 20 years of age has been reported to be twice as high as those without psoriasis[5-7].

The prevalence, duration, type and severity of the disease, psychosocial factors, accompanying comorbidities, previous treatments, the effectiveness and reliability of the chosen treatment, and patient compliance should all be considered in choosing a treatment.

Materials and Methods

The study was approved by the Uludağ University Faculty of Medicine Clinical Research Ethics Committee (approval number: 2019-6/24, date: 25.03.2019).

The study included 366 patients, whose comorbidity was investigated in 559 patients aged 18 below, who were followed up in Uludağ University Medical Faculty Hospital, Dermatology and Venereal Diseases Clinic and psoriasis outpatient clinic between January 2013 and December 2017 and diagnosed clinically or histopathologically. Patients' age, gender, family history, localization, clinical type (plaque, guttate, inverse, pustular, erythroderma, palmoplantar, arthritis, and nail involvement), clinical severity, treatments received, treatment durations, and responses to treatment were obtained from patient archive records. The presence of comorbidities, such as obesity, hyperlipidemia (total cholesterol >200 mg/dL, triglyceride >150 mg/dL, LDL >130 mg/dL), hypertension, diabetes mellitus (DM), coronary artery disease, and mood disorder were detected through the records. According to the current literature data, comorbidities were included in the study. Those with diseases, such as mental retardation, Down syndrome, and autism were excluded from the study because they may change the choice of treatment and compliance with treatment. Missing data were obtained from patients or their relatives. Body mass index (BMI) was calculated by measuring height and weight. In evaluating the severity of the disease, the psoriasis area severity index (PASI) and Physician Global Assessment (PGA), which can be used in cases where PASI cannot be applied, was taken as basis. According to these scales, if PASI score ≤10 and PGA score ≤2, it was defined as "mild plaque psoriasis." In case of PASI score <10, PGA score >2 and the presence of arthritis, visible area/scalp/genital/palmoplantar area/nail involvement, presence of resistant plaques, itching/pain/burning, the disease is considered as "moderate-severe psoriasis" has been defined. If the PASI score is >10 and the PGA score is >2, it was defined as "severe psoriasis." Treatments applied to patients were decided according to clinical severity. In mild psoriasis, topical treatments and phototherapy in resistant cases applications were recommended. Phototherapy, systemic conventional treatments (methotrexate, cyclosporine, and acitretin) or combination therapies were used in moderate-severe psoriasis. Biological agent treatments were used in the treatment of moderate-severe psoriasis or psoriatic arthritis (PsA) that did not respond to conventional systemic therapies, where these treatments were contraindicated or not tolerated by the patient.

The response status of the patients to the treatments used was recorded. While 75% or more regression in the PASI score (or PGA ≤2, PASI ≤5) is accepted as complete or almost complete remission; regression between 50% and 75% of PASI score (or PASI ≤10) partial remission; cases where improvement in PASI score of 50% or more (or PGA >2, PASI >10) were considered unresponsive. PGA >2, PASI >10 at the end of the induction phase, primary resistance, although there was no response to treatment during the induction phase, PGA >2 and PASI >10 during maintenance treatment was accepted as secondary resistance.

Statistical Analysis

Analyses were made in IBM SPSS version 21 program. Number (percentage), mean ± standard deviation, median (minimum-maximum) values were used in descriptive statistics. The suitability of the measurement values to the normal distribution was evaluated with the Kolmogorov-Smirnov test, and it was observed that all measurement evaluations were not suitable for normal distribution. For this reason, Mann-Whitney U test was used for the values obtained by measurement in intergroup comparisons. Chi-square test and Fisher's exact test were used for intergroup comparisons of census data. Statistical significance was accepted as $p<0.05$.

Results

At least one comorbidity was detected in 144 (39.3%) of 366 patients whose file information and patient history were investigated. Comorbidity was detected in 139 (96.5%) of the patients with comorbidity at the time of first application and in 5 (3.5%) of them during follow-up. Among the comorbidities, allergic rhinitis (8.1%) was the most common, and obesity was the second (7.1%). The distribution of comorbidities is presented in Table 1.

Two hundred and twenty-nine of the patients (62.6%) were women, 137 (37.4%) were men; 65% of those with comorbidity were girls

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and 35% were boys. Comorbidity was present in 95 (41.5%) of the girls and 49 (35.8%) of the boys. Therefore, this difference was not statistically significant (p=0.320). No statistically significant difference was found between those with and without comorbidities in terms of age, age of onset of disease, and family history. The duration of the disease was found to be statistically significantly longer in patients with comorbidity (p=0.043). Although the duration of treatment was longer than the group without treatment, it was not statistically significant (p=0.786). Plaque psoriasis was the most common in the group with and without comorbidity. Palmoplantar involvement was present in 18 (12.5%) of those with comorbidity and 7 (3.1%) of those without comorbidity (p=0.054). Scalp, nail, and facial involvement were higher in the group with comorbidity than those without. There was no relationship between joint involvement and comorbidity. A higher rate of comorbidity was observed in patients with severe psoriasis. The relationship of the patients with gender, age, age of onset, family history, duration of the disease, duration of treatment, clinical, and clinical severity are presented in Table 2.

Table 1. Comorbidities in pediatric psoriasis cases

Comorbidity	n (%)
Rheumatological diseases	
HSP	3 (0.8)
FMF	4 (1.0)
JRA	4 (1.0)
Endocrine system diseases	
Obesity	**26 (7.1)**
Hypothyroidism	**11 (3.0)**
Hyperlipidemia	**11 (3.0)**
Diabetes mellitus	8 (2.1)
PCOS	7 (1.9)
Hypertension	2 (0.5)
Dermatological diseases	
Vitiligo	4 (1.0)
Atopic dermatitis	3 (0.8)
Urticaria	3 (0.8)
Gastro-intestinal system diseases	
Celiac disease	1 (0.3)
Hepatosteatosis	4 (1.0)
Gastroesophageal reflux	4 (1.0)
Heart diseases	
Valvular disorders	**20 (5.4)**
ARF	2 (0.5)
Neurological diseases	
Epilepsy	14 (3.8)
Allergic diseases	
Allergic rhinitis	30 (8.1)
Asthma	16 (4.3)
Psychiatric disorders	
Anxiety	7 (1.9)
Depression	3 (0.8)
Malignancies	
Osteosarcoma	2 (0.5)
AML	1 (0.3)

HSP: Henoch-Schönlein purpura, FMF: Familial mediterranean fever, JRA: Juvenile rheumatoid arthritis, PCOS: Polycystic ovary syndrome, ARF: Acute rheumatic fever, AML: Acute myelocytic leukemia

We examined the clinical and demographic characteristics of the most common comorbidities (allergic rhinitis, obesity, valvular disorders, asthma, epilepsy, hyperlipidemia, and hypothyroidism) in our study group. The rate of allergic rhinitis was statistically significantly higher in girls than in boys (p=0.048). Although not statistically significant, epilepsy was more common in men.

In obese patients, the incidence of the disease at ≥12-18 years of age was statistically significantly higher than other comorbidities (p=0.034). In patients with hypothyroidism and valvular disorders, the incidence of <12 years of age was higher than other comorbidities. It was found that the age of onset of psoriasis was earlier in patients with hyperlipidemia. In those with obesity, it was found that the disease started at a statistically significantly later age (p=0.043). The gender and age distribution according to the presence of common comorbidities is presented in Table 3.

It was found that the disease duration was longer in patients with hyperlipidemia and asthma compared with others. It was found that the duration of treatment was statistically significantly shorter in allergic rhinitis patients (p=0.041) and longer in patients with valvular disorder (p=0.014). Generally, comorbidities were discovered with a high rate in patients with severe psoriasis, while those with epilepsy, asthma, allergic rhinitis, and valvular disorders were observed in mild severity. In patients with allergic rhinitis, the clinical severity of the disease was found to be mild at the statistical significance level (p=0.019). The rate of using only topical treatment was statistically significantly higher in the allergic rhinitis group compared with those without allergic rhinitis (p=0.015). Only phototherapy rate was highest in patients with valvular disorder. However, those with hypothyroidism and epilepsy did not receive only phototherapy. The rate of systemic treatment was found to be the most in obese patients and the least in those with allergic rhinitis. According to the presence of common comorbidities, the duration of the disease, the duration of the treatment, the clinical severity, and the treatment method are presented in Table 4.

Topical therapy was applied to all patients participating in the study. Systemic treatment was applied to 50% of those with comorbidity, and phototherapy was applied to 17.3%. Only phototherapy was applied to 10 (8%) of those with comorbidity (Table 5).

Considering the preference rates of acitretin, methotrexate, cyclosporine, and biological agents, which are systemic treatment options, compared with comorbidities, the most methotrexate (41.6%) and the least acitretin (6.9%) were preferred in patients with comorbidity and the use of biological agents in the comorbidity group (9.7%), it was found to be used statistically significantly more than the group without comorbidity (4.0%) (p=0.045). Distribution of systemic treatment options according to comorbidities is given in Table 6.

When the treatments received by the patients according to their BMI were evaluated, topical treatment was used in all patients. In general, systemic agent use was higher in overweight and obese patients. The most commonly used treatment other than topical treatment was

methotrexate. Biological agent use rate was found to be statistically significantly higher in obese patient (p=0.032) (Table 7).

When the treatment responses of the patients were evaluated, it was observed that the rates of complete remission and partial remission were lower, and the relapse rates were higher in the group with comorbidity compared with the group without comorbidity (Table 8).

When the treatment responses were examined according to the treatment options given to the patients, it was observed that the highest rate of complete remission in the group with comorbidity was observed in the group receiving phototherapy (24%), followed by the group receiving systemic therapy (20.8%). It was found that the partial remission rate was higher in phototherapy response in patients with comorbidities, and relapse rates were higher in systemic treatment responses. No statistical significance was found in any of the differences in these rates. The responses of the patients to phototherapy and systemic treatment according to the presence of comorbidity are presented in Table 9, 10.

When the treatment responses of the patients were evaluated, it was discovered that the relapse rates were higher in those who received only topical treatment and those with obesity and epilepsy, compared with the others. While the rate of complete remission was higher in those who received phototherapy treatment in addition to topical treatment, those with obesity and hyperlipidemia were more likely to have a partial remission rate in others. It was observed that the rate of complete remission was higher in those who received systemic treatment and those with obesity. The differences between the rates were not statistically significant. Treatment responses according to the presence of common comorbidities are presented in Table 11a, b, c.

Table 2. Demographic and clinical characteristics of the patients

	Comorbidity		
	No (222)	**Yes (144)**	**p**
Gender (n, %)			
Female	134 (58.5)	95 (41.5)	0.320
Male	88 (64.2)	49 (35.8)	
Age (years)			
Average ± SD Median (min.-max.)	11.95±4.31 12 (1-18)	12.35±4.20 12.5 (1-18)	0.680
<12 years	100 (45.0)	58 (40.2)	0.512
≥12-18 years	122 (54.9)	86 (59.7)	
Age of onset (years)			
Average ± SD Median (min.-max.)	8.63±4.21 9 (1-18)	8.57±4.23 9 (1-18)	0.984
Family history (n, %)	73 (32.8)	47 (32.6)	0.634
Duration of illness (months)			
Average ± SD Median (min.-max.)	57.03±46.16 48 (1-228)	65.03±46.83 48 (1-204)	**0.043**
Duration of treatment (months)			
Average ± SD Median (min.-max.)	10.04±10.47 7 (1-56)	10.95±10.50 7 (1-49)	0.786
Clinical (n, %)			
Plaque psoriasis	216 (97.3)	142 (98.6)	0.488*
Guttate psoriasis	6 (2.7)	2 (1.4)	0.488*
Pustular psoriasis	2 (0.9)	0 (0.0)	0.521*
Inverse psoriasis	18 (8.1)	10 (6.9)	0.841
Palmoplantar psoriasis	7 (3.1)	18 (12.5)	0.054
Facial psoriasis	14 (6.3)	16 (13.1)	0.091
Scalp psoriasis	150 (67.7)	106 (73.6)	0.244
Oral mucosal psoriasis	1 (0.5)	0 (0.0)	1.000*
Nail psoriasis	63 (28.3)	41 (28.4)	0.905
PsA	10 (4.5)	4 (2.7)	0.579
Clinical severity (n, %)			
Light	88 (56.1)	69 (43.9)	0.165
Middle	125 (66.3)	65 (34.7)	
Severe	9 (47.4)	10 (52.6)	

*Fisher's exact test. PsA: Psoriatic arthritis, SD: Standard deviation, min.: Minimum, max.: Maximum

Table 3. Demographic characteristics of patients according to common comorbidities

		Allergic rhinitis		Obesity		Valvular disorders		Asthma -		Epilepsy		Hyperlipidemia		Hypothyroidism	
		Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Gender, n (%)	Girl	205 (89.6)	24 (10.4)	224 (92.9)	17 (7.1)	225 (93.4)	16 (6.6)	216 (94.3)	13 (5.7)	221 (96.6)	8 (3.4)	234 (97.1)	7 (2.9)	233 (96.7)	8 (3.3)
	Male	131 (95.6)	6 (4.4)	134 (93.7)	9 (6.3)	139 (97.2)	4 (2.8)	134 (97.8)	3 (2.2)	131 (95.7)	6 (4.3)	139 (97.2)	4 (2.8)	140 (97.9)	3 (2.1)
	p	**0.048**		0.978		0.216		0.185		1.000*		1.000*		0.749	
Age groups, n (%)	<12 years	147 (43.8)	11 (36.7)	160 (44.7)	7 (26.9)	155 (42.6)	12 (60.0)	151 (43.2)	7 (43.8)	151 (42.8)	7 (50.0)	167 (43.1)	5 (45.5)	160 (42.9)	7 (63.6)
	≥12-18 years	1189 (56.2)	19 (63.3)	198 (55.3)	19 (73.1)	209 (57.4)	8 (40.0)	199 (56.8)	9 (56.2)	201 (57.4)	7 (50.0)	220 (56.9)	6 (54.5)	213 (57.1)	4 (36.4)
	p	0.239		**0.034**		0.204		**0.457**		0.124		0.799		0.115	
Starting age (years)	Average ± SD	8.57±4.21	8.00±4.53	8.45±4.23	10.29±3.91	8.52±4.25	9.39±3.71	8.55±4.20	8.87±5.01	8.54±4.20	9.21±4.88	8.44±4.05	6.70±3.59	8.54±4.26	9.45±2.84
	Median (min.-max.)	9 (1-18)	8 (2-18)	9 (1-18)	10 (3-17)	9 (1-18)	9 (1-16)	9 (1-18)	9 (2-16)	9 (1-18)	10.5 (1-17)	8 (1-18)	6.5 (1-12)	9 (1-18)	10 (5-14)
	p	0.638		**0.043**		0.824		0.329		0.480		0.720		0.481	

SD: Standard deviation, min.: Minimum, max.: Maximum

Table 4. Clinical characteristics of patients according to common comorbidities

		Allergic rhinitis		Obesity		Valvular disorders		Asthma		Epilepsy		Hyperlipidemia		Hypothyroidism	
		No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Duration of Sickness (months)	Average ± SD	62.43±47.92	51.42±51.50	61.69±48.61	61.58±42.53	62.27±48.55	50.72±39.95	60.76±47.72	82.73±55.19	62.65±48.65	38.21±25.85	67.77±9.56	86.40±54.78	61.91±48.47	54.73±38.92
	Median (min.-max.)	48 (1-228)	36 (2-204)	48 (1-228)	48 (2-156)	48 (1-228)	42 (1-144)	48 (1-228)	84 (5-204)	48 (1-228)	36 (7-96)	60 (1-228)	66 (24-204)	48 (1-228)	48 (2-144)
	p	0.521		0.982		1.000		0.146		0.799		0.750		0.627	
Duration of treatment (months)	Average ± SD	10.72±10.85	6.00±6.36	10.25±10.76	12.50±9.03	10.05±10.39	16.59±13.80	10.33±10.72	11.53±9.69	10.50±10.73	7.62±8.61	11.09±11.19	12.50±10.40	10.33±10.71	12.33±9.21
	Median (min-max)	7 (1-56)	4 (1-28)	7 (1-56)	11.5 (1-35)	7 (1-56)	12 (1-48)	7 (1-56)	10 (1-34)	7 (1-56)	4 (1-27)	7 (1-56)	11.5 (1-28)	7 (1-56)	12 (2-28)
	p	**0.041**		0.455		**0.044**		0.174		0.930		0.774		0.225	
Clinical Severity, n (%)	Light	137 (87.3)	20 (12.7)	146 (93.4)	11 (6.6)	148 (94.6)	9 (5.4)	148 (94.6)	9 (5.4)	149 (95.0)	8 (5.0)	153 (97.6)	4 (2.4)	151 (96.4)	6 (3.6)
	Middle	180 (94.8)	10 (5.2)	177 (93.4)	13 (6.9)	180 (94.9)	10 (5.1)	184 (97.0)	6 (3.0)	185 (97.4)	5 (2.6)	183 (96.5)	7 (3.5)	186 (98.0)	4 (2.0)
	Severe	19 (100.0)	0 (0.0)	17 (90.5)	2 (9.5)	18 (95.2)	1 (4.8)	18 (95.2)	1 (4.8)	18 (94.8)	1 (5.2)	19 (100.0)	0 (0.0)	18 (95.2)	1 (4.8)
	p	**0.019**		0.875		0.986		0.524		0.604		0.529		0.577	
Treatment, n (%)	Topical only	124 (36.6)	19 (63.3)	133 (39.8)	10 (38.5)	137 (38.5)	6 (30.0)	136 (38.7)	7 (43.8)	135 (38.1)	8 (57.1)	140 (39.4)	3 (27.3)	137 (38.5)	6 (54.5)
	Phototherapy only	15 (6.2)	3 (10.0)	17 (6.4)	1 (3.8)	15 (5.9)	3 (15.0)	16 (6.2)	2 (12.4)	18 (6.8)	0 (0.0)	17 (6.4)	1 (9.1)	18 (6.6)	0 (0.0)
	Systemic	197 (57.2)	8 (26.7)	190 (54.8)	15 (57.7)	194 (55.6)	11 (55.0)	198 (55.1)	7 (43.8)	199 (55.1)	6 (42.9)	198 (54.2)	7 (63.6)	200 (54.9)	5 (45.5)
	p	**0.015**		0.984		0.191		0.390		0.303		0.713		0.555	

*Fisher's exact test, SD: Standard deviation

Table 5. Treatment method applied according to presence of comorbidity

Treatment	Comorbidity (n, %)		
	No	Yes	p
Systemic treatment	133 (59.9)	72 (50.0)	0.132
Phototherapy	34 (15.3)	25 (17.3)	0.608

Table 6. Systemic agents used according to the presence of comorbidity distribution

	Comorbidity (n, %)		
Systemic treatment	**No**	**Yes**	**p**
Acitretin	15 (6.7)	10 (6.9)	0.833
Methotrexate	98 (44.1)	60 (41.6)	0.667
Cyclosporine	74 (33.3)	41 (28.4)	0.358
Biological agents			
Adalimumab	2 (0.9)	9 (6.25)	0.045
Etanercept	8 (2.2)	8 (5.5)	
Infliximab	0 (0.0)	3 (2.0)	
Ustekinumab	0 (0.0)	5 (3.4)	

The rate of complete remission in the group with comorbidity was 71.4% in the group using biological agents, followed by the group using methotrexate with 10% when responses to systemic treatment options acitretin, methotrexate, cyclosporine, and biological agents were evaluated. In the acitretin group, there was no complete remission. In terms of partial remission rates, partial remission was mostly achieved in the group using cyclosporine (61%) and the group using methotrexate (50%) in those with comorbidities. Most of the patients who were unresponsive to treatment were those who used acitretin (40%). Treatment responses according to the presence of comorbidity in those receiving systemic treatment are presented in Table 12.

When responses to systemic treatment options acitretin, methotrexate, cyclosporine, and biological agents were evaluated, it was found that the highest rate of complete remission in the group with comorbidity was in the group using biological agents, and this rate was higher in those with obesity (75%) and valvular disorders (75%) compared with the others was discovered. There was no complete remission in those using acitretin. When the rates of partial remission were examined, partial remission was mostly discovered in those who used cyclosporine in those with comorbidities, while those with allergic rhinitis, asthma, and hypothyroidism were discovered in those who

Table 7. Distribution of treatments used in patients according to BMI

(n, %)	Normal (297), (BMI ≤24.9)	Overweight (43), (BMI 25-29.9)	Obese (26), (BMI ≥30)	p
Topical treatment	297 (100)	43 (100)	26 (100)	-
Phototherapy	50 (16.8)	5 (11.6)	4 (15.3)	0.758
Systemic treatment				
Acitretin	23 (7.7)	0 (0.0)	2 (7.6)	0.167
Methotrexate	130 (43.7)	16 (37.2)	12 (46.1)	0.642
Cyclosporine	90 (30.2)	14 (32.5)	11 (42.3)	0.356
Biological agents	19 (6.3)	0 (0.0)	4 (15.3)	**0.032**
Adalimumab	9 (3.0)	0 (0.0)	2 (7.6)	
Etanercept	11 (3.7)	0 (0.0)	2 (7.6)	
Infliximab	2 (0.6)	0 (0.0)	1 (3.8)	
Ustekinumab	3 (1.0)	0 (0.0)	2 (7.6)	

BMI: Body mass index

Table 8. Treatment response by presence of comorbidity

	Comorbidity n (%)		
Treatment response	**No**	**Yes**	**p**
Complete remission	49 (22.1)	31 (21.5)	0.688
Partial remission	112 (50.4)	67 (46.5)	
Relapse	61 (27.5)	46 (32.0)	

Table 9. Phototherapy response by presence of comorbidity

	Comorbidity n (%)		
Treatment response	**None**	**Yes**	**p**
Complete remission	3 (8.8)	6 (24.0)	0.198
Partial remission	19 (55.9)	12 (48.0)	
Relapse	4 (11.8)	1 (4.0)	
Unanswered	8 (23.5)	6 (24.0)	

received methotrexate. Unresponsiveness to treatment was generally discovered in those receiving acitretin. The differences between the rates were not statistically significant. Responses to systemic agents according to the presence of common comorbidities are presented in Table 13a, b.

The rate of non-response to topical treatment was high in all patients when the response to the treatments used in the patients was evaluated according to the BMI. Partial remission rates were found to be higher in phototherapy treatment. In general, the response to conventional systemic agents was less in those who were overweight and obese. In biological agents, the rate of complete remission was higher in obese patients. There was no use of biological agents in overweight patients (Table 14).

Table 10. Systemic treatment response by presence of comorbidity

	Comorbidity n (%)		
Treatment response	**None**	**Yes**	**p**
Complete remission	24 (18.0)	15 (20.8)	0.181
Partial remission	74 (56.6)	32 (44.4)	
Relapse	35 (26.4)	25 (34.8)	

Discussion

Psoriasis is a chronic inflammatory disease in which many genetic, environmental, and immunological factors play a role in its etiopathogenesis. In addition to skin symptoms, psoriasis is accompanied by metabolic, autoimmune, and psychosocial comorbidities with similar pathogenetic mechanisms. In some sources, psoriasis is currently considered not only as a skin disease but as a systemic inflammatory disease.[1-5] It is believed that severe inflammation discovered in psoriasis has a role in the development of comorbidity.[8,9] Comorbidities, which affect the choice and effectiveness of treatment, are thus more common in patients with moderate and severe psoriasis.[5-7] Severe inflammation discovered in psoriasis causes insulin resistance, a decrease in nitric oxide, an increase in adhesion molecules and consequently endothelial dysfunction, and it is believed that the resulting endothelial dysfunction increases the risk of atherosclerosis, coronary artery disease, cerebrovascular, and

Table 11a. Topical treatment only response by the presence of common comorbidities

		Allergic rhinitis		Obesity		Valvular disorders		Asthma		Epilepsy		Hyperlipidemia		Hypothyroidism	
		No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Treatment response, n (%)	Complete	26 (21.5)	4 (21.0)	29 (22.3)	0 (0.0)	30 (22.4)	0 (0.0)	28 (21.1)	1 (14.2)	29 (22.0)	1 (12.5)	29 (21.2)	1 (33.3)	29 (21.6)	0 (0.0)
	Partial	57 (45.4)	9 (47.4)	62 (46.0)	4 (40.0)	62 (44.7)	4 (66.7)	55 (40.2)	4 (57.2)	63 (46.1)	2 (25.0)	63 (44.5)	2 (66.7)	62 (44.8)	4 (66.7)
	Relapse	41 (33.1)	6 (31.6)	42 (31.7)	6 (60.0)	45 (32.9)	2 (33.3)	53 (38.7)	2 (28.6)	43 (31.9)	5 (62.5)	48 (34.3)	0 (0.0)	46 (33.6)	2 (33.3)
	p	0.213		0.494		0.430		0.927		0.368		0.757		0.4552	

Table 11b. Phototherapy response according to the presence of common comorbidities

		Allergic rhinitis		Obesity		Valvular disorders		Asthma		Epilepsy	Hyperlipidemia		Hypothyroidism
		No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**-**	**No**	**Yes**	**-**
Treatment response, n (%)	Complete	6 (38.1)	1 (33.3)	5 (30.4)	1 (100.0)	8 (53.3)	1 (33.3)	6 (36.4)	1 (50.0)	-	5 (30.4)	1 (100.0)	-
	Partial	8 (47.6)	2 (66.7)	11 (56.5)	0 (0.0)	3 (20.0)	2 (66.7)	9 (50.0)	1 (50.0)	-	11 (56.5)	0 (0.0)	-
	Relapse	1 (14.3)	0 (0.0)	1 (13.1)	0 (0.0)	4 (26.7)	0 (0.0)	1 (13.6)	0 (0.0)	-	1 (13.1)	0 (0.0)	-
	p	0.756		0.910		0.669		0.154		-	0.355		-

Table 11c. Systemic treatment response by presence of common comorbidities

		Allergic rhinitis		Obesity		Valvular disorders		Asthma		Epilepsy		Hyperlipidemia		Hypothyroidism	
		No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Treatment response, n (%)	Complete	37 (19.2)	1 (12.5)	34 (18.9)	5 (33.3)	36 (18.3)	2 (18.2)	36 (18.6)	2 (28.6)	37 (19.0)	1 (16.7)	40 (19.6)	0 (0.0)	38 (19.4)	0 (0.0)
	Partial	103 (51.7)	5 (62.5)	102 (52.0)	6 (40.0)	103 (53.8)	5 (45.5)	104 (52.0)	4 (57.1)	106 (52.7)	2 (33.3)	105 (51.5)	5 (71.4)	106 (52.4)	2 (40.0)
	Relapse	57	2 (25.0)	54 (29.1)	4 (26.7)	55 (27.9)	4 (36.4)	58 (29.4)	1 (14.3)	56 (28.3)	3 (50.0)	59 (28.9)	2 (28.6)	56 (28.2)	3 (60.0)
	p	0.945		0.331		0.734		0.694		0.673		0.504		0.482	

peripheral vascular disease (psoriatic march).[8,9] Most of the studies on comorbidities accompanying psoriasis with different patient groups and different methodologies are associated with metabolic diseases (obesity, dyslipidemia, hypertension, and DM).[5,6,10-14] A few studies have investigated allergic diseases, arthritis, and psychiatric diseases in addition to metabolic diseases. Klufas et al.[15] showed that psoriasis was accompanied by comorbidities, such as asthma, atopic dermatitis, depression, and obesity, respectively. In the study of Bronckers et al.[16] (psychiatric disorders) and in the study of Augustin et al.[17] (atopic eczema), allergic rhinitis, asthma, and obesity were reported to be discovered at a higher rate than other comorbidities. In the study by Ong et al.[18] (evaluating autoimmune diseases), it was reported that epilepsy was observed more frequently, especially in psoriasis, at a statistically significant level. Among the comorbidities, we investigated under nine main headings (Table 1); allergic rhinitis, obesity, and valvular disorders were found with a high rate, respectively. In Bursa, the rate of allergic rhinitis was reported to be 12.6% in children between the ages of 6 and 14 who were evaluated with a questionnaire study based on the International Study of Asthma and Allergies in Childhood protocol.[19] Because of this, we believed that the rate of allergic rhinitis in our psoriasis patients was high.

Total immunoglobulin E (IgE) levels were high in psoriasis patients and correlated with disease severity and disease duration, according to the study by Werynska-Kalemba et al.[20], that examined the relationship between atopy and psoriasis. No evaluation could be made on this issue because the total IgE levels were not measured in our patients. The relationship between thyroid diseases and psoriasis is unclear; studies have been frequently evaluated on adults, and it has been reported that thyroid diseases frequently accompany those with PsA.[21-25] In the study of Vassilatou et al.[26], it was reported that there was no relationship between thyroid disease and psoriasis. There are insufficient data on thyroid disease and childhood psoriasis. In our study, allergic rhinitis and obesity were discovered at a lower rate compared with normal pediatric population and adult psoriasis. Valvular disorders were detected at a higher rate compared with the normal pediatric population. We believed that the rate was high due to the small number of total patients in our study compared with other studies. Coronary heart diseases frequently accompanied adult psoriasis. Asthma and epilepsy were observed at similar rates in normal pediatric population and adult psoriasis, and hyperlipidemia and hypothyroidism were less common than pediatric population and adult psoriasis (Table 15).[18,21,23-47]

Table 12. Response to systemic agents according to presence of comorbidity

	Comorbidityi n (%)		
	No	**Yes**	**p**
Acitretin			
Partial remission	10 (66.7)	5 (50.0)	0.875
Relapse	1 (6.7)	1 (10.0)	
Unanswered	4 (26.6)	4 (40.0)	
Methotrexate			
Complete remission	16 (16.3)	6 (10.0)	0.346
Partial remission	46 (46.9)	30 (50.0)	-
Relapse	16 (16.3)	18 (30.0)	-
Unanswered	20 (20.5)	6 (10.0)	-
Cyclosporine			
Complete remission	6 (8.1)	3 (7.3)	0.962
Partial remission	47 (63.5)	25 (61.0)	-
Relapse	13 (17.5)	7 (17.1)	-
Unanswered	8 (10.9)	6 (14.6)	-
Biological agents			
Complete remission	5 (55.5)	10 (71.4)	0.383
Partial remission	1 (11.1)	3 (21.4)	-
Relapse	0 (0.0)	0 (0.0)	-
Primary resistance	2 (22.3)	1 (7.2)	-
Secondary resistance	1 (11.1)	0 (0.0)	-

It is noteworthy that psoriasis does not make any gender difference in adults, and it is more common in girls in children.[47-49] In our study, generally female gender was dominant. In addition, it was noteworthy that comorbidities were discovered with a higher rate in girls. When we evaluate the comorbidities separately, in our study, allergic diseases were higher in girls than boys. In a study conducted on adult psoriasis in which the relationship between atopy and psoriasis was investigated, it was reported that the majority of psoriasis patients with atopy were women.[50]

Valvular disorders and obesity were more common in girls. In the study of Kwa et al.[51] (obesity and cardiovascular diseases) (arhythmia and valvular cardiopathy), in the study of Zhu et al.[52] and Bryld et al.[53] (obesity) reported that was observed with a higher rate in girls. In the study conducted by Boccardi et al.[7], it was reported that obesity was more common in men. Unlike other comorbidities and literature data, 18 epilepsy was discovered at a higher rate in men in our study. There is no pediatric study on thyroid and psoriasis, and Antonelli et al.[25] and Fallahi et al.[23] showed thyroid diseases more frequently in women in their study on adult psoriasis. In our study, thyroid diseases were discovered with a high rate in girls, as in adults.

In all age groups, it has been reported that comorbidities are more common in psoriasis patients than in patients without psoriasis.[13] In our study, it was generally observed that psoriasis patients with comorbidity were ≥12 years of age. Kelati et al.[12] reported that psoriasis patients with comorbidity were ≤12 years of age, and metabolic comorbidities (obesity, dyslipidemia, and metabolic syndrome) were ≥12 years of age. When we evaluated comorbidities separately, it was discovered that children with allergic diseases and psoriasis were often ≥12 and ≤18 years of age. There were not enough data in the literature regarding pediatric age group psoriasis and atopy. It was reported in only one study that allergen sensitivity was higher before <40 years of age and decreased after.[50] We found that obesity is mostly discovered in patients aged ≥12 and ≤18 years of age. Boccardi et al.[7] and Kwa et al.[51] reported obesity ≤10 years of age higher in their studies, while Bryld et al.[53] reported that obesity was observed at a high rate of ≥12 years of age. In the study performed by Kwa et al.[51], cardiovascular diseases were more common between the ages of 10 and 17, while it was more common in our small number of patients aged of ≤12 years. Ong et al.[18] reported that epilepsy is more common in children with psoriasis than in adults. No data were available on age for other comorbidities.

In our study, statistically insignificant differences were found in terms of the relationship between comorbidities and age of occurrence. In the literature, data on this subject were contradictory. However, we can conclude that obesity is discovered more frequently at the age of ≥12 and ≤18 years based on our own results and literature data. In our study, it was observed that the age of onset of psoriasis was generally earlier in patients with comorbidity than those without comorbidity. When we evaluated the comorbidities separately, we found that the age of onset was earlier in those with allergic rhinitis and hyperlipidemia, and later in those with obesity, valvular disorders, asthma, hypothyroidism, and epilepsy. Only the late age of onset of psoriasis patients with obesity compared with non-obese patients was statistically significant (p=0.043). Ergun et al.[54] reported that the age of onset of psoriasis is later in those with obesity. In our study, the mean age of onset was 10.29±3.91 yr in obese children with psoriasis, while it was 8.7±3.1 years in the study of Becker et al.[55] According to our study data, we think that the age of onset of psoriasis has a role in the development of comorbidity, but there is a need for prospective large series studies on this subject. Approximately 30% of pediatric patients have a family history of psoriasis.[48,56,57] In our study, 32.7% of the patients had a family history. However, the fact that this rate was found to be lower in patients with comorbidity (39.2%) compared with those without comorbidity (60.8%) suggested that there was no significant relationship between family history and comorbidity.

In our study, similar to the results of Kelati et al.[12], the duration of the disease was found to be significantly longer in psoriasis patients with comorbidities (p=0.043). When we evaluate the comorbidities separately, in our study, it was found that the disease duration was longer in patients with hyperlipidemia compared with other comorbidities, but no comparison could be made due to the lack of other data on this subject.

In psoriasis patients with obesity, the duration of the disease was calculated as 5.1±3.5 years, and there was no significant difference compared with non-obese patients (p=0.982). In the only study related to disease duration and obesity in pediatric psoriasis patients, Becker et al.[55] found the mean disease duration to be 4.3±3.1 years. In the study of Antonelli et al.[25], it was reported that the duration of the disease in adult psoriasis patients with thyroid disease was longer than in those without thyroid disease. In our study, no relationship was found with the duration of the disease in pediatric psoriasis patients with thyroid disease. Since there was not enough data about other comorbidities and duration of the disease, evaluation could not be made.

In general, the long duration of the disease in patients with comorbidities suggests that comorbidities may affect the clinical course of psoriasis and prospective studies are needed on this subject. Plaque psoriasis

Table 13a. Response to systemic agents according to presence of common comorbidities

			Allergic rhinitis			Obesity			Valvular disorders			Asthma		
			No	Yes	p	No	Yes	p	No	Yes	p	No	Yes	p
Treatment response, n (%)	Acitretin	Complete	-	-	-	0 (0.0)	0 (0.0)	0.785	0 (0.0)	0 (0.0)	0.183	0 (0.0)	0 (0.0)	0.284
		Partial	-	-		13 (56.5)	2 (100.0)		13 (59.1)	2 (67.7)		15 (62.5)	0 (0.0)	
		Relapse	-	-		2 (8.7)	0 (0.0)		2 (9.1)	0 (0.0)		2 (8.3)	0 (0.0)	
		Unanswered	-	-		8 (34.8)	0 (0.0)		7 (31.8)	1 (33.3)		7 (29.2)	1 (100.0)	
	Methotrexate	Complete	26 (39.0)	0 (0.0)	0.092	20 (13.9)	1 (8.3)	0.445	19 (13.0)	2 (20.0)	0.828	23 (14.1)	0 (0.0)	0.740
		Partial	81 (49.0)	4 (80.0)		71 (49.3)	7 (58.3)		75 (50.7)	4 (40.0)		73 (49.0)	5 (71.4)	
		Relapse	35 (19.9)	1 (20.0)		27 (18.8)	4 (33.3)		28 (19.2)	3 (30.0)		30 (21.1)	1 (14.3)	
		Unanswered	32 (17.0)	0 (0.0)		28 (18.1)	0 (0.0)		26 (17.1)	1 (10.0)		25 (16.8)	1 (14.3)	
	Cyclosporine	Complete	7 (6.5)	1 (20.0)	0.541	7 (6.9)	1 (9.1)	0.157	8 (7.4)	0 (0.0)	0.737	9 (7.3)	0 (0.0)	0.071
		Partial	71 (64.8)	3 (60.0)		67 (64.7)	7 (63.6)		68 (63.0)	5 (100.0)		71 (65.1)	2 (50.0)	
		Relapse	18 (16.7)	1 (20.0)		19 (17.6)	1 (9.1)		20 (17.6)	0 (0.0)		20 (17.4)	0 (0.0)	
		Unanswered	1412.0)	0 (0.0)		10 (10.8)	2 (18.2)		14 (12.0)	0 (0.0)		11 (10.1)	2 (50.0)	
	Biological agents	Complete	-	-	-	13 (59.1)	3 (75.0)	0.647	11 (59.1)	3 (75.0)	0.783	13 (60.9)	2 (66.7)	0.776
		Partial	-	-		3 (18.2)	0 (0.0)		3 (13.6)	1 (25.0)		2 (13.0)	1 (33.3)	
		Relapse	-	-		1 (4.5)	0 (0.0)		1 (4.5)	0 (0.0)		1 (4.3)	0 (0.0)	
		Unanswered	-	-		3 (18.2)	1 (25.0)		4 (22.7)	0 (0.0)		4 (21.7)	0 (0.0)	

is the most common form of psoriasis in both adults and children; It is discovered in 75% of children and 90% of adults.[58-60] In our study, plaque psoriasis was found to be the most common clinical form in the group with and without comorbidity. Kelati et al.[12] and Tom et al.[61] reported that plaque psoriasis was the most common clinical form, and pustular and erythrodermic form and nail and facial involvement were more common in patients with comorbidity. In the study of Becker et al.[55], it was reported that scalp involvement was frequently observed in obese patients. In our study, there was no patient with erythrodermic psoriasis; pustular psoriasis was located in palmoplantar and was not discovered in patients with comorbidity. Scalp, facial, palmoplantar, and nail involvement were also discovered at a higher rate in those with comorbidities than those without. However, no statistical significance was found between these differences. There was no significant difference between the two groups in joint involvement. In our study, patients with comorbidities were discovered with a higher rate in severe psoriasis patients than those without. In the study of Kelati et al.[12], it was shown that psoriasis was more severe in patients with comorbidities. In the study of Paller et al.[62], the clinical severity of psoriasis patients with comorbidity was generally mild. It has been reported to be moderate and severe in those with obesity, hypertension, and anxiety.

It is among the reports that the probability of the metabolic syndrome components is higher in patients with severe psoriasis than in mild psoriasis.[63,64] In the study of Zhu et al.[52], it was clinically severe in obese patients, while it was mild and severe in the study of Becker et al.[55] In the study of Ergun et al.[54], no relationship was found between obesity and psoriasis severity. In our study, patients with obesity and hyperlipidemia were frequently discovered clinically at moderate and severe levels.

In our study, the clinical picture of cardiovascular diseases was often mild. Tom et al.[61] reported that in psoriasis patients in whom cardiovascular diseases and dyslipidemia were investigated, the clinical severity was often moderate and severe. In our study, in accordance with the study of Egeberg et al.[65], it was found that psoriasis patients with asthma were frequently mild in severity.

There was no relationship between thyroid disease and the clinical severity of psoriasis, according to the study by Fallahi et al.[23]. In our study, it was observed that the clinical picture of patients with thyroid disease was severe. Patients with epilepsy and allergic rhinitis were clinically mild in our study, although there was not enough data on this subject. Although the clinical severity of comorbidities was generally mild and moderate in our study, when evaluated separately, clinical severity data were different. This suggests that prospective studies are needed to obtain more robust data in evaluating the relationship between clinical course and comorbidity.

Studies have reported that phototherapy and systemic agents are frequently used in patients with moderate and severe psoriasis.[55,66] Generally, systemic therapy was used in our study and the most preferred systemic agent was methotrexate. Bronckers et al.[16] and Eichenfield et al.[67] reported that the most used agent was methotrexate, while Kwon et al.[68] It has been reported that acitretin is highly preferred. Acitretin was the least preferred conventional agent in our study. When we evaluate the relationship between comorbidities and treatment response; in our study, in patients with comorbidities, overall remission rates were low, relapse rates were higher, and the rate of complete remission was higher in those using biological agents. Patients with allergic rhinitis and epilepsy did not use biological agents, and the rate of complete remission was higher in those using cyclosporine and methotrexate, respectively. Studies have frequently investigated the effects of obesity on treatment responses, and there is not enough data on other comorbidities. High pre-treatment BMI has been associated with decreased response to systemic treatments.[69-73] In addition, it has been shown in randomized controlled studies that weight loss during systemic therapy increases treatment efficacy.[74,75] The mechanism of action on BMI and treatment efficiency of obesity is still unclear. It has been suggested that the decrease in drug efficacy is

Table 13b. Response to systemic agents according to presence of common comorbidities

			Epilepsy			Hyperlipidemia			Hypothyroidism		
			No	Yes	p	No	Yes	p	No	Yes	p
Treatment response, n (%)	Acitretin	Complete	0 (0.0)	0 (0.0)	0.939	0 (0.0)	0 (0.0)	0.078	0 (0.0)	0 (0.0)	0.375
		Partial	14 (58.3)	1 (100.0)		15 (62.5)	0 (0.0)		15 (62.5)	0 (0.0)	
		Relapse	2 (8.3)	0 (0.0)		2 (8.3)	0 (0.0)		2 (8.3)	0 (0.0)	
		Unanswered	8 (33.3)	0 (0.0)		7 (29.2)	1 (100.0)		7 (29.2)	1 (100.0)	
	Methotrexate	Complete	18 (11.9)	3 (60.0)	0.095	22 (14.0)	0 (0.0)	0.749	21 (13.8)	0 (0.0)	0.822
		Partial	78 (51.0)	1 (20.0)		91 (50.0)	4 (50.0)		74 (49.3)	3 (75.0)	
		Relapse	30 (19.9)	1 (20.0)		32 (19.3)	1 (33.3)		31 (19.7)	1 (25.0)	
		Unanswered	27 (17.2)	0 (0.0)		19 (16.7)	1 (16.7)		26 (17.1)	0 (0.0)	
	Cyclosporine	Complete	8 (7.1)	0 (0.0)	0.624	9 (7.3)	0 (0.0)	0.892	8 (7.3)	0 (0.0)	0.234
		Partial	72 (64.3)	1 (100.0)		70 (63.6)	3 (100.0)		73 (65.5)	1 (33.3)	
		Relapse	20 (17.0)	0 (0.0)		20 (17.3)	0 (0.0)		18 (15.5)	2 (67.7)	
		Unanswered	13 (11.6)	0 (0.0)		13 (11.8)	0 (0.0)		13 (11.8)	0 (0.0)	
	Biological agents	Complete	-	-	-	14 (62.5)	1 (50.0)	0.591	14 (60.0)	1 (100.0)	0.906
		Partial	-	-		3 (12.5)	1 (50.0)		3 (16.0)	0 (0.0)	
		Relapse	-	-		1 (4.2)	0 (0.0)		1 (4.0)	0 (0.0)	
		Unanswered	-	-		4 (20.8)	0 (0.0)		4 (20.0)	0 (0.0)	

due to increased inflammation in obese patients, as well as decreased bioavailability of drugs due to increased adiposity and deterioration of pharmacokinetics.[76-78] In our study, we found that the rate of complete remission with systemic treatment was higher in obese patients than in non-obese patients, although it was not statistically significant (p=0.275). Systemic treatment was preferred more in obese patients and especially the rate of biological agent use was higher than those without.

It has been reported in the literature that the use of biological agents provides significant clinical improvement in obesity and other comorbidities.[79-81] When we evaluated the treatment and responses of the patients according to BMI in our study, less systemic agents

Table 14. Used in patients according to BMI response to treatments

(n, %)	Normal (297), (BMI ≤24.9)	Overweight (43), (BMI 25-29.9)	Obese (26), (BMI ≥30)	p
Topical treatment				
Complete remission	26 (8.7)	3 (6.9)	0 (0.0)	0.530
Partial remission	52 (17.5)	6 (13.9)	4 (15.3)	
Relapse	31 (10.5)	7 (16.4)	4 (15.3)	
Unanswered	188 (63.3)	27 (62.8)	18 (69.4)	
Phototherapy				
Complete remission	7 (2.4)	1 (2.3)	1 (3.8)	0.918
Partial remission	28 (9.4)	3 (7.0)	1 (3.8)	
Relapse	3 (1.1)	1 (2.3)	0 (0.0)	
Unanswered	12 (4.1)	0 (0.0)	2 (7.6)	
Acitretin				
Partial remission	13 (4.3)	0 (0.0)	2 (0.6)	0.729
Relapse	2 (0.6)	0 (0.0)	0 (0.0)	
Unanswered	8 (2.6)	0 (0.0)	0 (0.0)	
Methotrexate				
Complete remission	20 (6.7)	2 (4.6)	1 (3.8)	0.668
Partial remission	60 (20.2)	9 (20.9)	7 (26.9)	
Relapse	24 (8.1)	4 (9.3)	4 (15.3)	
Unanswered	26 (8.7)	1 (2.3)	0 (0.0)	
Cyclosporine				
Complete remission	7 (2.3)	2 (4.6)	1 (3.8)	0.430
Partial remission	63 (21.2)	7 (16.2)	7 (26.9)	
Relapse	18 (6.0)	3 (6.9)	1 (3.8)	
Unanswered	12 (4.0)	1 (2.3)	2 (7.6)	
Biological agents				
Complete remission	12 (4.0)	0 (0.0)	3 (11.5)	0.647
Partial remission	4 (1.3)	0 (0.0)	0 (0.0)	
Relapse	0 (0.0)	0 (0.0)	0 (0.0)	
Unanswered	3 (1.0)	0 (0.0)	1 (3.8)	

BMI: Body mass index

Table 15. Distributions of common diseases in pediatric population without psoriasis and adult psoriasis

Comorbidity	Current study, n (%)	Pediatric population, (%)*	Adult psoriasis, (%)**
Allergic rhinitis	30 (8.1)	10-30	23
Obesity	26 (7.1)	13-20.6	6-48
Valvular disorders	20 (5.4)	0.01-0.05	21***
Asthma	16 (4.3)	1-18	1.9
Epilepsy	14 (3.8)	0.05-0.8	0.7
Hyperlipidemia	11 (3.0)	20	38-45
Hypothyroidism	11 (3.0)	6.3	3-34

*Literature 27-43, **Literature 18.21.44-47, ***The rate in coronary heart diseases

were used in the overweight patients compared with the obese patients, and there was no significant correlation in treatment responses. In obese patients, the rate of complete remission was higher in those using biological agents. There are opinions that the use of conventional systemic agents (methotrexate, cyclosporine) in adult patients reduces the risk of cardiovascular disease by reducing inflammation.[82,83] Since cardiovascular diseases, such as coronary heart disease and ischemic heart disease, did not accompany in our study, we could not make an evaluation on this issue. The use of systemic agents was higher in our patients compared with other treatment options, and this rate was also higher in patients with comorbidities, but although there was no statistical significance between these differences, our study suggests that accompanying comorbidities may affect treatment selection and efficacy. Comorbidities accompanying pediatric psoriasis according to current literature and our study are summarized in Table 16.

Conclusion

Systemic inflammation causes many comorbidities in the pathogenesis of psoriasis. Therefore, in the follow-up of patients with psoriasis, the presence of systemic effects, the development of other comorbidities, and early and effective treatment should be performed when they occur. It should be kept in mind that starting appropriate treatments at the right time, especially in young and severe psoriasis patients, may reduce important risk factors.

Our study is retrospective and although the number of cases is low, it is important in that it has comprehensive data examining the relationship between comorbidities and treatment response and our findings suggest that the investigation and recognition of comorbidities affecting the treatment process is an important part of pediatric psoriasis patient management. Prospective studies with larger series will more clearly reveal the relationship between comorbidities in the pediatric age group, the course of psoriasis and treatment response.

Table 16. Studies related to comorbidities in psoriasis

Study	Year	Population	Method	Related conditions
Boccardi et al.[7]	2009	<15 years old 96 psoriasis patients, 100 control group with other skin diseases	Case control	Overweight obesity male ≤10 years
Wu et al.[84]	2010	<14 years and younger 137 psoriasis patients	Cross-sectional	Allergic contact dermatitis vitiligo Alopesia areata
Bryld et al.[53]	2010	1,074 children with psoriasis	Cohort	Overweight obesity girl ≥12 years
Zhu et al.[52]	2012	<15 years of age 332 psoriasis patients 146 healthy controls	Case control	Overweight obesity K=E ≥11 years Severe
Paller et al.[62]	2019	5-17 years, 409 psoriasis patients 205 healthy controls	Cross-sectional	Obesity abdominal obesity girl Age 12 Severe
Becker et al.[55]	2014	27 pediatric patients with psoriasis	Retrospective pilot cohort	Overweight obesity girl Age 12 severe Systemic therapy
Egeberg et al.[65]	2015	6,586 children with psoriasis	Cohort	Asthma Mild clinical violence
Werynska-Kalemba et al.[20]	2016	80 psoriasis patients 50 patients without psoriasis	Case control	Allergic reactions: correlate with IgE level, clinical severity, and disease duration
Augustin et al.[17]	2015	1,313 children with psoriasis 30,354 children with atopic eczema	Case control	Atopic eczema Allergic rhinitis asthma Obesity
Kelati et al.[12]	2017	<18 years and under 160 psoriasis patients: 84 with comorbidities and 76 without comorbidities	Cross-sectional	Abdominal obesity overweight dyslipidemia Valvular cardiopathy asthma celiac disease vitiligo alopesia areata epilepsy Girl <12 years Plaque type, facial, and nail involvement Severe
Our work	2019	366 pediatric psoriasis: 144 with comorbidities and 222 without comorbidities	Retrospective	Obesity hyperlipidemia psoriatic arthritis valvular cardiopathy asthma Allergic rhinitis hypothyroidism epilepsy Girl ≥12 and ≤18 years moderate Plaque type, facial, nail involvement Systemic treatment

Ethics

Ethics Committee Approval: The study was approved by the Uludağ University Faculty of Medicine Clinical Research Ethics Committee (approval number: 2019-6/24, date: 25.03.2019).

Informed Consent: Since it is a retrospective study, the consent of the patients was not obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: G.M., H.S., S.Y., E.B.B., K.A., Concept: G.M., H.S., S.Y., E.B.B., K.A., Design: P G.M., H.S., S.Y., E.B.B., K.A., Data Collection or Processing: G.M., H.S., S.Y., E.B.B., K.A., Analysis or Interpretation: G.M., H.S., S.Y., E.B.B., K.A., Literature Search: G.M., H.S., S.Y., E.B.B., K.A., Writing: G.M., H.S., S.Y., E.B.B., K.A.

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