Dermatology Practical & Conceptual

The Relative Frequency of Small Vessel Cerebrovascular Disease and Brain Atrophy in MRI of Patients with Psoriasis

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ABSTRACT

Introduction: Psoriasis is a systemic autoimmune disease that is associated with numerous comorbidities.

Objective: This study aimed to compare the prevalence of small vessel cerebrovascular disease (SVCD) and atrophic brain changes in MRI of patients with psoriasis and normal subjects.

Methods: This case-control study was performed on 27 patients with psoriasis and 27 normal individuals who were referred to Shohada-e-Tajrish Hospital, Tehran, Iran during 2019 and 2020. Basic demographic and clinical information of participants were recorded. Brain MRI was performed for all individuals to examine the medial temporal atrophy (MTA) score, global cortical atrophy (GCA) score, and Fazekas scale. Finally, the relative frequencies of each parameter between the two groups were compared.

Results: There was no significant difference in the frequency of the Fazekas scale, GCA, and MTA scores between the two groups. However, a mild trend was found for a higher frequency of Fazekas scale, GCA, and MTA scores in controls in comparison with the case group. While there was no significant relationship between the Fazekas scale and disease duration ($p=0.16$), a significant and positive correlation was found between disease duration and GCA and MTA scores [$p<0.001$). There was no significant relationship between Fazekas, GCA and MTA status and other parameters.

Conclusions: The increase in disease duration was significantly associated with an increase in the incidence of cerebral atrophy, which may suggest the need for screening in terms of CNS involvement in psoriasis patients.

Introduction

Psoriasis is a polygenic immune-inflammatory skin disease [1]. A variety of environmental factors may elicit disease in predisposed individuals. It affects 0.6-5% of the general population in different communities [2]. Psoriasis affects about 8 million adults in the United States, and its overall prevalence in developed countries is about 2% to 3% [3]. The incidence of psoriasis in Iran has been reported between 1.3% and 2.5% (4, 5]. About 75% of psoriasis patients have at least one comorbidity such as dyslipidemia, hypertension, diabetes, cardiovascular disease, uveitis, inflammatory bowel disease, osteoporosis and bone involvement, and obstructive pulmonary disease [6].

Some studies have described various neurological and psychiatric involvement such as seizure, stroke, Guillain-Barré syndrome, migraine, and myasthenia gravis in patients with psoriasis. Additionally, there seems to be a higher incidence of cardiovascular and cerebrovascular disease in patients with psoriasis even after eliminating confounding risk factors of vascular disease such as stroke[7].

Small vessel cerebrovascular disease (SVCD) is caused by damage to cerebral microcirculation and often affects the white matter of the brain [8]. About 45% of dementia is caused by SVCD and it accounts for approximately 20% of all strokes worldwide [9, 10]. Clinically, these lesions can range from silent disease to evidence of lacunar infarction, vascular dementia, and other distinct neurological symptoms [11]. Radiological findings include subcortical infarcts, and in advanced stages can be characterized as white matter hyperintensities (WMH), enlargement of the perivascular spaces, lacunae, cerebral microbleeds and atrophy [8, 12]. Depression, cognitive impairment and gait problems, stroke, dementia, and mood disturbance are also commonly found in patients who suffer from SVCD[8]. To the best of our knowledge, no study has examined the extent and the incidence of CSVD in conventional brain MRI of patients with psoriasis. Therefore, we designed and conducted a study to compare the prevalence of SVCD and atrophic changes in conventional MRI of patients with psoriasis in comparison with the control group using medial temporal atrophy (MTA) score, global cortical atrophy (GCA) score and Fazekas scale.

Materials and Methods

This case-control study was conducted on 27 patients with psoriasis and 27 healthy individuals aged 18-60 years old who had been referred to the dermatology department of Shohadaye Tajrish Hospital (Tehran, Iran) between 2019 and 2020. Healthy controls were age and sex-matched individuals who were referred to the dermatology clinic for cosmetic concerns. They also had no considerable history of dermatological disease or previous medical diseases. The control subjects were matched to patients by age and sex. Both groups did not declare past medical history of neurological disease. This case-control study was approved by the institutional review board and ethical committee of Shahid Beheshti University of Medical Sciences. Written informed consent forms were signed by all individuals, including case and control participants. Demographic data of all patients, including gender and age, as well as their medical history, habitual history (including smoking habit), disease duration, nail involvement, and other comorbidities were recorded.

Brain MRI was performed for all patients and controls with the following setting: TR = 9.8 ms; TE = 4.6 ms; flip angle = 8; section thickness = 1.2 mm; number of sections = 120; no section gap; whole-brain coverage; FOV = 224 mm; matrix = 192; reconstruction matrix = 256. Finally, the MTA score, GCA score and Fazekas scale were calculated by an assistant professor of diagnostic radiology with 4 years of experience, to estimate the frequency of brain atrophy and small vessel cerebrovascular disease in each group. The radiologist was blind to whether the images belonged to the case or control group. MTA is a score from 0 to 4 for the assessment of cognitive impairment. The GCA scale is a qualitative rating system from 0 to 3 established to measure cerebral atrophy. The Fazekas scale is used to quantify high signal lesions on T2-weighted imaging in deep white matter and periventricular regions that are usually attributed to chronic small vessel disease (Figure 1) [13].

Statistical Analysis

The results were presented as mean ± standard deviation (SD) for quantitative variables and were summarized by absolute frequencies and percentages for categorical variables. Categorical variables were compared using chi-square test or Fisher's exact test. Quantitative variables were also compared with t-test or Mann U test. In this study, $p<0.05$ was considered statistically significant. The SPSS software (IBM, version 19) was applied for the analysis of data.

Results

A total number of 27 consecutive patients with psoriasis and a mean age of 48.14 ± 5.41 years old were entered into the study. The majority of cases (17 out of 27 (63%)) were males. The basic demographic and disease characteristics of all patients are summarized in Table 1. Most patients (74.1%) had nail involvement. Approximately 33% of patients exhibited arthritis and exacerbation. The mean disease duration and PASI score were 10.59 years and 13.74 respectively.

Comparison of the Fazekas scale, GCA and MTA scores between study participants are shown in Table 2. There was

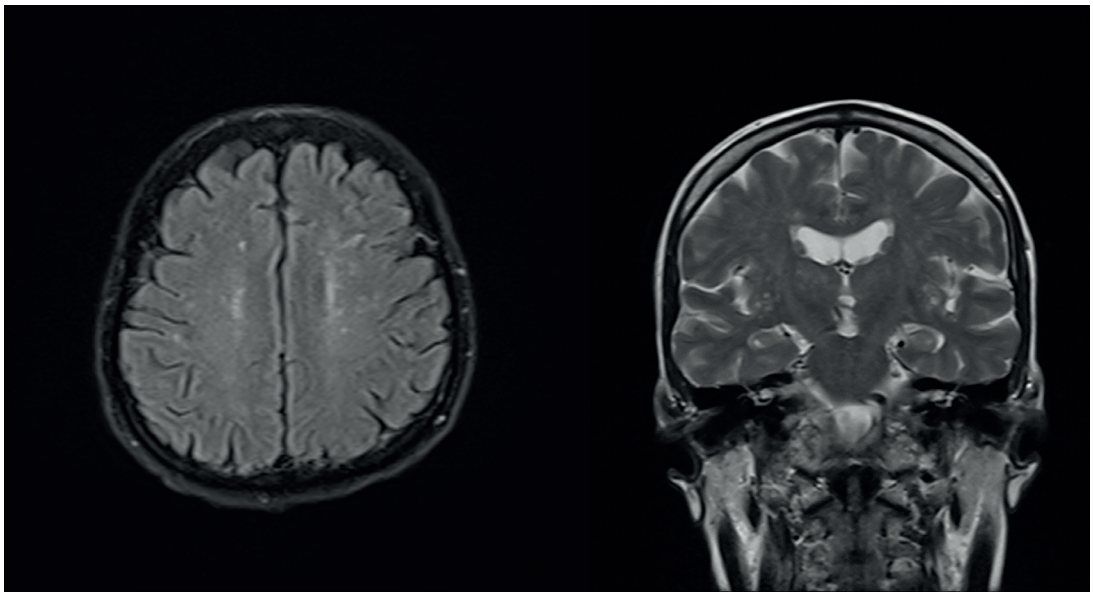

Figure 1. Magnetic resonance imaging of 51-year-old Male Known Case with 16 Years Involvement with psoriasis. Mild periventricular and subcortical T2-weighted hyper signal lesions are seen due to small vessel disease (arrows)

Table 1: The basic demographic and clinical characteristics of patients.

Variables	Results
Age (Years)	48.14 ± 5.41
Gender	
Male (%)	17 (63%)
Female (%)	10 (37%)
Smoking	
Yes (%)	4 (14.8%)
No (%)	23 (85.2%)
Underlying diseases	
No (%)	23 (85.2%)
Hyperlipidemia (%)	1 (3.7%)
Hyper TG (%)	1 (3.7%)
Diabetes (%)	2 (7.4%)
Nail involvement	
Yes (%)	20 (74.1%)
No (%)	7 (25.9%)
Arthritis	
Yes (%)	9 (33.3%)
No (%)	18 (66.7%)
Exacerbation	
Yes (%)	10 (37%)
No (%)	17 (63%)
Disease duration (year)	10.59 ± 7.91
PASI score	13.74 ± 4.42
Drug therapy	
Methotrexate (month)	27.7 ± 17.65
Phototherapy (session)	15.23 ± 8.3
Cyclosporin (month)	14.48 ± 6.5
Acitretin (month)	2.3 ± 0.4
Sinora (month)	15.7 ± 3.4

Table 2: Comparison of the Fazekas, GCA and MTA between patients and control.

	Control	Case	p-value
Fazekas scale			
0	15 (55.5%)	14 (51.8%)	0.13
1	7 (25.9%)	9 (33.3%)	
2	5 (18.5%)	5 (18.5%)	
3	0 (0.0%)	0 (0.0%)	
GCA scale			
0	24 (88.9%)	20 (74.1%)	0.75
1	3 (11.1%)	4 (14.8%)	
2	0 (0.00%)	2 (7.4%)	
3	0 (0.00%)	1 (3.7%)	
MTA scale			
0	25 (92.6%)	25 (92.6%)	0.87
1	2 (7.4%)	2 (7.4%)	
2	0 (0.00%)	0 (0.00%)	
3	0 (0.00%)	0 (0.00%)	
4	0 (0.00%)	0 (0.00%)	

no significant difference in the frequency of the Fazekas scale, GCA and MTA scores between the two groups. However, a mild trend was found for a higher frequency of Fazekas, GCA and MTA with normal status in controls than case group.

The relationships between the Fazekas scale, GCA and MTA scores with other parameters are shown in Table 3. While there was no significant relationship between the Fazekas scale and disease duration (p=0.16), a significant and positive correlation was found between disease duration with GCA and MTA scores (p<0.001). There was no

Table 3: The relationship between Fazekas, GCA and MTA with other parameters.

	Fazekas	GCA	MTA
Age	0.37	0.29	0.41
Gender	0.64	0.26	0.69
Smoking	0.72	0.28	0.41
Underlying diseases	0.28	0.3	0.47
Nail involvement	0.42	0.23	0.28
Arthritis	0.52	0.67	0.39
Exacerbation	0.35	0.29	0.45
PASI score	0.54	0.46	0.54
Disease duration	0.16	<0.001	<0.001

significant relationship between the Fazekas scale, GCA and MTA scores with other parameters such as age, gender, smoking, nail involvement, PASI score, and GCA.

Discussion

In this study, the relative frequency of brain atrophy and small vessel cerebrovascular disease in brain MRI of patients with psoriasis and normal subjects was compared to age and sex-matched normal individuals. Our results showed that there was no significant difference in chronic small vessel disease measured by Fazekas score. Additionally, the indices of GCA (referring to brain atrophy) and MTA (referring to cognitive impairment) were not significantly different among the case and control groups.

According to our results, age, sex, smoking, disease severity (measured by PASI score) and nail involvement did not have an impact on GCA, MTA scales and Fazekas score.

Interestingly, brain atrophy and cognitive impairment measured by GCA and MTA scales respectively were found to significantly correlate with the disease duration in psoriasis patients. Longer duration of the disease was significantly associated with an increase in cerebral atrophy. This finding can be associated with the fact that chronic plaque psoriasis is an immune-mediated inflammatory skin disease that is strongly associated with the clinical features of metabolic syndrome, and metabolic syndrome can cause alteration in the brain [2, 3]. To the best of our knowledge, the current investigation was the first to reveal an association between psoriasis and increased risk of cerebral atrophy.

Several studies have reported the association between psoriasis and other brain disorders, including cognitive disorders. For example, Gisondi *et al.*[2], examined the association between psoriasis and cognitive impairment in a case-control design revealing that psoriasis significantly associates with impaired cognitive function.

Similarly, Brown *et al.* [13], reported that psoriasis may be associated with increased cognitive impairment in these patients. In another study, Innamorati *et al.*, [14] evaluated the association between psoriasis and cognitive impairment in 50 patients with psoriasis and 50 normal individuals. They found that patients with psoriasis had more prominent cognitive impairment, anxiety, depression as well as poorer quality of life.

Recently, Najafi *et al.*, [15] examined the anatomical and functional status of the brain in 14 patients with psoriasis and 15 healthy individuals. They also found that chronic psoriasis could alter brain anatomy. The results of this study are closely consistent with the findings of our research emphasizing that psoriasis could affect brain structures. As in our study, they showed an increased risk of cerebral atrophy in patients with long-term psoriasis. Highlighting the significance of CNS investigation in patients with relevant history and symptoms.

Conversely, in a recent population-based study, Elena Pezzolo *et al.*[4] found that cognitive test scores and volumetric, microstructural, focal measures on brain MRI did not differ between psoriasis and non-psoriasis participants. They concluded that in this population-based study, psoriasis was not associated with preclinical markers or higher dementia risk. This study differs from our study in terms of the method of white matter evaluation since we subjectively illustrated the white matter changes by Fazekas score.

Limitations

One of the limitations of this study was the small sample size, which probably affected the comparative results between the control and patient groups to achieve significant differences. Therefore, another study with larger sample size, as well as a long-term cohort can be performed to investigate the association of psoriasis with these parameters.

Conclusions

Results from the current case-control study support that psoriasis patients are at risk of developing brain atrophy evaluated by Fazekas score. Our study showed that the disease duration in psoriasis patients exhibited a significant relationship with cerebral atrophy. An increase in the disease duration was significantly associated with an increase in the incidence of cerebral atrophy, which can confirm the importance of follow-up for these patients.

This study provides new insight into comorbidities associated with psoriasis and the necessity of screening psoriasis patients for neurological manifestations.

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