Int J Clin Exp Med 2020;13(4):2555-2564
www.ijcem.com /ISSN:1940-5901/IJCEM0106151

Original Article

Analysis of clinical features in 499 psoriasis patients with metabolic syndrome

Panhong Wu[1], Xuefeng Guo[2], Mengxiang Li[3], Yongsheng Liu[4], Lifang Guo[4], Zhao Wei[1], Aimin Liu[1], Yuemin Wang[7], Li Wang[1], Buxin Zhang[1], Yinglin Cui[5], Shixiang Hu[6]

[1]Dermatological Department, Henan Hospital of Traditional Chinese Medicine, Zhengzhou, Henan, China; [2]Dermatological Department, Zhengzhou Hospital of Traditional Chinese Medicine, Zhengzhou, Henan, China; [3]College of Information Engineering, Henan University of Science and Technology, Henan, China; [4]Physical Examination, Henan Hospital of Traditional Chinese Medicine, Zhengzhou, Henan, China; [5]Henan Hospital of Traditional Chinese Medicine, Zhengzhou, Henan, China; [6]Surgical Department, Henan Hospital of Traditional Chinese Medicine, Zhengzhou, Henan, China; [7]Zhengzhou Huiji District People's Hospital, Henan, China

Received December 9, 2019; Accepted December 29, 2019; Epub April 15, 2020; Published April 30, 2020

Abstract: Objective: To find the clinical features of psoriasis patients with metabolic syndrome (MS), its underlying etiology and pathogenesis, and the reaction between the severity of psoriasis and the onset of MS in patients with psoriasis. Method: Materials were obtained from 499 patients due to psoriasis vulgaris, 263 hospitalized patients due to allergic diseases and 340 individuals who received physical examination at the same stage from Sep. 1, 2011 to Dec. 31, 2017. Basic materials covered name, gender, age, body weight, height, BP, lipids, Glu and PASI score for patients with psoriasis. China Clinical Dermatology (2012, Zhao Bian) and diagnosis standards issued by the Diabetic Branch of Chinese Medical Association (2004) were referred to for diagnosis of psoriasis with MS respectively. Result: General materials were collected from 1102 individuals, of whom, 499 were patients with psoriasis, including 11 at mild (≤ 2% BSA), 353 at moderate (2-10%) and 135 at severe degree (> 10%); 603 were included in the control group, of whom, 263 had allergic diseases and 340 were healthy. The study showed a relationship between psoriasis and MS as compared with healthy individuals and patients with allergic diseases, which was stronger in skin damage due to psoriasis worsened. Meanwhile, compared with patients with psoriasis only, psoriasis patients with MS demonstrated a longer LOS and high medical expenses on an average basis, which indicated the rising difficulty to treat psoriasis if it is accompanied by MS to a certain degree. Conclusion: Effective management is necessary to prevent MS in patients with psoriasis, especially those who are mild, while regular scientific popularization and screening for metabolic diseases are required in most severe cases of psoriasis.

Keywords: Clinical features, psoriasis patients, metabolic syndrome

Introduction

MS is defined as a pathological status under which metabolic disorder is observed in terms of protein, fat, and carbohydrate in human body, a clustering of complicated metabolic disorder syndromes, and a hazard leading to diabetic cardiovascular and cerebrovascular diseases, and manifested in various metabolic disorders, including obesity, hyperglycemia, hypertension, and dyslipidemia which constitute the pathological foundation of cardiovascular and cerebrovascular diseases as well as diabetes [1, 2]. At present, it is generally accepted that MS is related to IR and hyperinsulinemia [3]. It may worsen the skin damage and increase the difficulty of treatment and the probability of cardiovascular and cerebrovascular diseases in patients with psoriasis [4].

Psoriasis is a common chronic and recurrent inflammatory dermatosis mediated by autoimmunity in dermatology, found in almost 1% of the global population [3] with an incidence between 0.47 and 3% worldwide [5]. Epidemiological evidences make clear that psoriasis is associated with frequent cardiovascular risk factors and adverse cardiovascular effects, including myocardial infarction, apoplexia and cardiovascular death. Psoriasis, particularly those which are severe, may be a risk factor leading to ASCVD beyond traditional risk factors

Table 1. General information of the 1102 study objects

Classification	Observation Group	Control Group 1 Allergic Disease	Control Group 2 Healthy
Number of study objects	499	262	339
PASI score			
Mild psoriasis ≤ 2%	11 (2.2%)	N/A	N/A
Moderate psoriasis 2-10%	353 (70.74%)	N/A	N/A
Severe psoriasis > 10%	136 (27.25%)	N/A	N/A
Gender			
M	363 (72.75%)	125 (47.71%)	235 (69.32%)
F	136 (27.25%)	137 (52.29%)	104 (30.68%)
Age			
Mean ± standard deviation	40.81±14.74	48.07±18.42	37.58±9.35

as patients with severe psoriasis generally die at an age 5 years younger than patients without psoriasis. Cardiovascular disease is the mostly commonly reported cause to the death of patients with psoriasis [6], while fasting BSL and DBP are closely associated with the severity of psoriasis (PASI) [7].

In this study, 499 psoriasis patients with MS were observed to understand their clinical features which were then analyzed to produce guiding suggestions for clinical prevention and treatment of psoriasis.

Material and methods

General information

Materials were obtained from 1102 study objects admitted to the Department of Dermatology of Henan Province Hospital of TCM due to psoriasis vulgaris from Sep. 1, 2011 to Dec. 31, 2017. **Table 1** describes the general information of 1102 study objects, of whom, 499 were included into the observation group, 363 males and 136 females with average age of 40.81±14.74. They were patients with psoriasis discharged from the Department of Dermatology of Henan Province Hospital of TCM from Sep. 13, 2011 to Jan. 16, 2016, of whom, 11 (2%) suffered from mild psoriasis (≤ 2% BSA), 353 (71%) from moderate psoriasis (3-10%), and 136 (27%) from severe psoriasis (> 10%). 2 control groups were set up, of which, the allergic disease group included 262 patients who were discharged at the Department of Dermatology of Henan Provincial Hospital of TCM from Sep. 20, 2011 to Oct. 29, 2014, 125 males and 127 females with average age of 48.07±18.42; the healthy group contained 339 patients, 235 males and 104 females with average age of 37.58±9.35. All patients provided complete information about BMI, Glu, BP and lipids (TG, TC, HDL and LDL) which were comparable in data analysis as variables.

Inclusion criteria: All 1102 study objects with average age of 40.81±14.74 that were routinely examined and delivered in the Dermatology of Henan Province Hospital of TCM. The allergic disease group were conformed with diagnose.

The exclusion criteria: The patient was diagnosed with liver and kidney dysfunction, rickets, and malnutrition, etc. Other examination data were incomplete.

Basic materials covered name, gender, age, body weight, height, BP, lipids, Glu and PA.

SI score for patients with psoriasis. China Clinical Dermatology (2012, Zhao Bian) and diagnosis standards issued by the Diabetic Branch of Chinese Medical Association (2004) were referred to for diagnosis of psoriasis with MS respectively.

Methods

Body mass index is a simple calculation using a person's height and weight. The formula is BMI = kg/m^2 where kg is a person's weight in kilograms and m2 is their height in meters squared. To determine the blood GLU and lipid levels, a total of 3 ml fasting venous blood was collected from the subjects into separation gel tubes and separated at 3,466 g for 10 min. The plasma was analyzed in a Hitachi 705/717 biochemical instrument (Hitachi, Ltd., Tokyo, Japan) at 20°C. The fasting blood GLU, TG, TC, HDL and LDL levels were then determined.

Statistical analysis

Statistical analysis was performed using SPSS 23.0 software. T-test was used for the normal distribution of the measurement data. Wilcoxon signed-rank test was used for the data that did

Table 2. Describes the quartiles of various indices in the three groups

	Observation Group psoriasis	Control Group 1 allergic disease	Control Group 2 Healthy
BMI	24.57 (15.56, 38.75)	23.39 (14.81, 34.60)	24.17 (15.24, 36.83)
SBP (mmHg)	120 (80, 180)	120 (90, 168)	115 (88, 175)
DBP (mmHg)	80 (50, 110)	75.5 (44, 108)	71 (51, 114)
BSL (mmol/l)	4.99 (2.89, 19.31)	5.00 (3.34, 13.33)	5.19 (4.19, 15.26)
TG (mmol/l)	1.34 (0.33, 15.03)	1.325 (0.10, 10.06)	1.28 (0.35, 18.78)
TC (mmol/l)	4.63 (2.14, 8.78)	4.75 (2.08, 8.37)	4.35 (2.11, 7.97)
HDL (mmol/l)	1.07 (0.48, 2.25)	1.22 (0.65, 2.05)	1.12 (0.58, 2.4)
LDL (mmol/l)	2.68 (1.08, 6.32)	2.74 (0.88, 5.50)	2.51 (0.78, 4.84)
MS (n, %)	58 (11.62%)	21 (8.02%)	25 (7.37%)

not satisfy the normal distribution. The relationship between the factors and psoriasis patients was analyzed using multivariate logistic regression analysis. The Spearman rank correlation analysis method was used. F test was used for multiple sets of measurement data, and the post-test LSD method was used for comparison between groups.

Results

Abnormally rising BMI was more likely in patients with psoriasis

Tables 2 and **3** indicate the quartile corresponding to each metabolic index of the 3 groups, the number of normal cases and abnormal cases as well as the or value by comparing the indices of the observation group with the two control groups. Comparison of BMI found that the observation group had a minimum, maximum and median BMI of 15.56, 38.75, and 24.57 respectively; according to reports from patients with psoriasis, 13 had a BMI < 18, 254 had a BMI ≥ 18 and < 25, 197 had a BMI ≥ 5, 5 and < 30, and 35 had a BMI ≥ 30, of whom, 232 were abnormal and accounted for 46.49% of the observation group; the control group 1 had a minimum, maximum and median BMI of 14.81, 34.60, and 23.39 respectively; 179 reported a BMI ≥ 18 and < 25, 79 reported a BMI ≥ 25 and < 30, and 4 reported a BMI ≥ 30, of whom, 83 were abnormal and accounted for 31.68% of the control group 1; the control group 2 had a minimum, maximum and median BMI of 15.24, 36.83, and 24.17 respectively; 6 reported a BMI < 18, 184 reported a BMI ≥ 18 and < 25, 135 reported a BMI ≥ 25 and < 30, and 14 reported a BMI ≥ 30, of whom, 149 were abnormal and accounted for 43.95% of the control group 2. Compared with the control groups 1 and 2, the observation group demonstrated an or value of BMI at 1.87 and 1.11 respectively, indicating that abnormally rising BMI, manifested as obesity, was more likely in patients with psoriasis as compared with patients with allergic disease and healthy individuals. Data of various populations from the three groups indicated that psoriasis may be one of the possible risk factors leading to abnormal rise of BMI (as shown in **Tables 2** and **3**).

Rising BP was more likely in patients with psoriasis

Comparison of BP found that the observation group had a minimum, maximum and median SBP and DBP of 80 mmHg, 180 mmHg and 120 mmHg, 50 mmHg, 110 mmHg and 80 mmHg respectively; 404 patients reported a DBP < 90 mmHg and/or SBP < 140 mmHg (80.96%) and 95 patients reported a DBP ≥ 90 mmHg and SBP ≥ 140 mmHg (19.04%); the control group 1 had a minimum, maximum and median SBP and DBP of 90 mmHg, 168 mmHg and 120 mmHg, 44 mmHg, 108 mmHg and 75.5 mmHg respectively; 215 patients reported a DBP < 90 mmHg and/or SBP < 140 mmHg (82.06%) and 47 patients reported a DBP ≥ 90 mmHg and SBP ≥ 140 mmHg (17.94%); the control group 2 had a minimum, maximum and median SBP and DBP of 88 mmHg, 175 mmHg and 115 mmHg, 51 mmHg, 114 mmHg and 71 mmHg respectively; 304 patients reported a DBP < 90 mmHg and/or SBP < 140 mmHg (89.68%) and 35 patients reported a DBP ≥ 90 mmHg and SBP ≥ 140 mmHg (10.32%). Compared with the control groups 1 and 2, the observation group demonstrated an or value of BP at 1.08 and 2.04 respectively, indicating that rising BP was more likely in patients with psoriasis as compared with patients with allergic disease and healthy individuals; psoriasis

Table 3. Normal and abnormal cases of various indices in the three groups, and the OR value

Various metabolic indices	Observation Group		Control Group 1 Allergic disease		Control Group 2 Healthy		Or (psoriasis/ allergic disease)	Or (psoriasis/ healthy)
	Normal (n, %)	Abnormal (n, %)	Normal (n, %)	Abnormal (n, %)	Normal (n, %)	Abnormal (n, %)		
BMI	254, 50.9%	245, 49.1%	17, 68.32%	83, 31.68%	184, 54.27%	149, 43.95%	1.87	1.11
BP (mmHg)	404, 80.96%	95, 19.04%	215, 82.06%	47, 17.94%	304, 89.68%	35, 10.32%	1.08	2.04
BSL (mmol/l)	432, 86.57%	67, 13.43%	224, 85.5%	38, 14.5%	315, 92.92%	24, 7.08%	1.09	2.03
TG (mmol/l)	339, 67.94%	160, 32.06%	178, 87.94%	84, 32.06%	226, 66.66%	113, 33.34%	1.00	0.94
TC (mmol/l)	422, 84.57%	77, 15.43%	221, 84.35%	41, 15.65%	316, 93.22%	23, 6.78%	0.98	2.50
HDL (mmol/l)	390, 78.16%	109, 21.84%	218, 83.21%	44, 16.79%	269, 79.35%	70, 20.65%	0.59	1.00
LDL (mmol/l)	419, 83.97%	80, 16.03%	215, 82.06%	47, 17.94%	311, 91.74%	28, 8.26%	1.03	2.12
MS (n, %)	441, 88.38%	58, 11.62%	241, 91.92%	21, 8.02%	314, 92.63%	25, 7.37%	1.51	1.66

Note: abnormal BMI: BMI ≥ 25 or < 18; abnormal BP: SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg; abnormal BSL: BSL ≥ 6.1 mmol/l; abnormal TG: T G ≥ 1.71 mmol/l; abnormal TC: TC ≥ 5.8 mmol/l; abnormal HDL: HDL < 0.9 mmol/l (Male) or < 1.0 mmol/l (Female); abnormal LDL: LDL ≥ 3.5 mmol/l.

may be one of the possible risk factors leading to abnormal rise of BP (as shown in **Tables 2** and **3**).

Rising Glu was more likely in patients with psoriasis

Comparison of Glu found that the observation group had a minimum, maximum and median BSL of 2.89 mmol/l, 19.31 mmol/l and 4.99 mmol/l respectively; 432 patients reported a BSL < 6.1 mmol/l (86.57%) and 67 reported a BSL ≥ 6.1 mmol/l (13.43%); control group 1 had a minimum, maximum and median BSL of 3.34 mmol/l, 13.33 mmol/l and 5.00 mmol/l respectively; 224 patients reported a BSL < 6.1 mmol/l (85.5%) and 42 reported a BSL ≥ 6.1 mmol/l (14.5%); the control group 2 had a minimum, maximum and median BSL of 4.19 mmol/l, 15.26 mmol/l and 5.19 mmol/l respectively; 315 patients reported a BSL < 6.1 mmol/l (92.92%) and 24 reported a BSL ≥ 6.1 mmol/l (7.08%). Compared with the control groups 1 and 2, the observation group demonstrated an or value of BSL at 1.09 and 2.03 respectively, indicating that rising Glu was more likely in patients with psoriasis as compared with patients with allergic disease and healthy individuals; psoriasis may be one of the possible risk factors leading to abnormal rise of Glu (as shown in **Tables 2** and **3**).

Patients with psoriasis, population with allergic diseases, and healthy individuals were almost equal in the probability of abnormal TG

Comparison of TG found that the observation group had a minimum, maximum and median TG of 0.33 mmol/l, 15.03 mmol/l and 1.34 mmol/l respectively; 339 patients reported a TG < 1.71 mmol/l (67.94%) and 160 reported a TG ≥ 1.71 mmol/l (32.06%); control group 1 had a minimum, maximum and median TG of 0.10 mmol/l, 10.06 mmol/l and 1.325 mmol/l respectively; 178 patients reported a TG < 1.71 mmol/l (87.94%) and 87 reported a TG ≥ 1.71 mmol/l (32.06%); control group 2 had a minimum, maximum and median TG of 0.35 mmol/l, 18.78 mmol/l and 1.28 mmol/l respectively; 226 patients reported a TG < 1.71 mmol/l (66.66%) and 113 reported a TG ≥ 1.71 mmol/l (33.34%). Compared with the control groups 1 and 2, the observation group demonstrated an or value of TG at 1.00 and 0.94 respectively, indicating that patients with psoriasis, population with allergic diseases, and healthy individuals were almost equal in the probability of abnormal TG (as shown in **Tables 2** and **3**).

Patients with psoriasis has a probability of abnormal TC rise equal to populations with allergic disease

Comparison of TC found that the observation group had a minimum, maximum and median TC of 2.14 mmol/l, 8.78 mmol/l and 4.63 mmol/l respectively; 422 patients reported a TC < 5.8 mmol/l (84.57%) and 77 reported a TC ≥ 5.8 mmol/l (15.43%); the control group 1 had a minimum, maximum and median TC of 2.08 mmol/l, 8.37 mmol/l and 4.75 mmol/l respectively; 221 patients reported a TC < 5.8 mmol/l (84.35%) and 41 reported a TC ≥ 5.8 mmol/l (15.65%); the control group 2 had a minimum, maximum and median TC of 2.11 mmol/l, 7.97 mmol/l and 4.35 mmol/l respectively; 316 patients reported a TC < 5.8 mmol/l (93.22%) and 23 reported a TC ≥ 5.8 mmol/l (6.78%). Compared with the control groups 1 and 2, the observation group demonstrated an or value of TC at 0.98 and 2.5 respectively, indicating that patients with psoriasis has a probability of abnormal TC rise equal to populations with allergic disease, and statistically different from healthy individuals. Psoriasis may be one of the possible risk factors leading to abnormal rise of TC (as shown in **Tables 2** and **3**).

Patients with psoriasis, population with allergic diseases, and healthy individuals were almost equal in the probability of abnormal HDL

Comparison of HDL found that the observation group had a minimum, maximum and median HDL level of 0.48 mmol/l, 2.25 mmol/l and 1.07 mmol/l respectively; 390 patients reported a HDL ≥ 0.9 mmol/l (male) or 1.0 mmol/l (female) (78.16%) and 109 reported a HDL < 0.9 mmol/l (male) or 1.0 mmol/l (female) (21.84%); the control group 1 had a minimum, maximum and median HDL level of 0.65 mmol/l, 2.05 mmol/l and 1.22 mmol/l respectively; 218 patients reported a HDL ≥ 0.9 mmol/l (male) or 1.0 mmol/l (female) (83.21%) and 44 reported a HDL < 0.9 mmol/l (male) or 1.0 mmol/l (female) (16.79%); the control group 2 had a minimum, maximum and median HDL level of 0.58 mmol/l, 2.4 mmol/l and 1.12 mmol/l respectively; 269 patients reported a HDL ≥ 0.9 mmol/l (male) or 1.0 mmol/l (female) (79.35%) and 70 reported a HDL < 0.9 mmol/l (male) or 1.0 mmol/l (female) (20.65%). Com-

Table 4. Relation between various metabolic indices and severity of psoriasis in patients with psoriasis

Metabolic Indices	Total Number of Abnormal Cases in the Observation Group	Mild (11)	Moderate (353)	Severe (135)
BMI ≥ 25	232 (46.49%)	1 (0.91%)	109 (30.88%)	122 (90.37%)
BSL ≥ 6.1 mmol/l	67 (13.42%)	1 (0.91%)	37 (10.48%)	29 (21.48%)
SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg	95 (19.03%)	0	45 (12.75%)	50 (37.04%)
TG ≥ 1.7 mmol/1	160 (32.1%)	1 (0.91%)	92 (26.06%)	67 (49.63%)
HDL-C < 0.9 mml/L (Male) or < 1.0 mmol/L (Female)	109 (15.43%)	5 (45.45%)	80 (22.66%)	24 (17.78%)
MS	58 (11.62%)	0	14 (3.97%)	44 (32.59%)

pared with the control groups 1 and 2, the observation group demonstrated or a value of HDL at 0.59 and 1.00 respectively, indicating that patients with psoriasis, population with allergic diseases, and healthy individuals were almost equal in the probability of abnormal HDL.

Patients with psoriasis has a probability of abnormal LDL rise statistically

Comparison of LDL found that the observation group had a minimum, maximum and median LDL level of 0.88 mmol/l, 5.50 mmol/l and 2.68 mmol/l respectively; 419 patients reported a LDL < 3.5 mmol/l (male) (83.97%) and 80 reported a LDL ≥ 3.5 mmol/l (16.03%); the control group 1 had a minimum, maximum and median LDL level of 0.88 mmol/l, 5.50 mmol/l and 2.74 mmol/l respectively; 215 patients reported a LDL < 3.5 mmol/l (male) (82.06%) and 47 reported a LDL ≥ 3.5 mmol/l (17.94%); the control group 2 had a minimum, maximum and median LDL level of 0.78 mmol/l, 4.84 mmol/l and 2.51 mmol/l respectively; 311 patients reported a LDL < 3.5 mmol/l (male) (91.74%) and 28 reported a LDL ≥ 3.5 mmol/l (8.26%). Compared with the control groups 1 and 2, the observation group demonstrated or a value of LDL at 1.01 and 2.12 respectively, indicating that patients with psoriasis has a probability of abnormal LDL rise statistically different from populations with allergic disease, and healthy individuals. Psoriasis may be one of the possible risk factors leading to abnormal rise of LDL (as shown in **Tables 2** and **3**).

Patients with psoriasis has a higher probability of MS and psoriasis

For number of MS case and percentage, the observation group reported 58 (11.62%), the control group 1 reported 21 (8.02%) and the control group 2 reported 25 (7.37%). Compared with the control groups 1 and 2, the observation group demonstrated an or value of number of MS case at 1.51 and 1.66 respectively, indicating that patients with psoriasis has a higher probability of MS and psoriasis may be one of the possible risk factors leading to MS.

Through observation of MS composition, a statistically significant abnormal rise was observed in the observation group in terms of BMI, BP, Glu and LDL as compared with the control groups 1 and 2, which may be risk factors leading to MS in patients with psoriasis (as shown in **Tables 2** and **3**).

As psoriasis becomes serious, various metabolic indices rise proportionally

Table 4 and **Figure 1** have described the relationship between various metabolic indices and the severity of psoriasis in patients with psoriasis. The observation group (n = 499) reported 232 cases of abnormal BMI, including 1 case in patients with mild psoriasis (0.91%), 109 in patients with moderate psoriasis (30.88%) and 122 in patients with severe psoriasis (90.37%); 232 cases of abnormal BSL, including 1 case in patients with mild psoriasis (0.91%), 37 in patients with moderate psoriasis (10.48%) and 29 in patients with severe psoriasis (21.48%); 95 cases of abnormal BP, including 0 case in patients with mild psoriasis (0.00%), 45 in patients with moderate psoriasis (12.75%) and 50 in patients with severe psoriasis (37.04%); 160 cases of abnormal TG, including 1 case in patients with mild psoriasis (0.91%), 92 in patients with moderate psoriasis (26.06%) and 67 in patients with severe psoriasis (49.63%); 109 cases of abnormal HDL, including 5 cases in patients with mild psoriasis (45.45%), 80 in patients with moderate psoriasis (22.66%) and 24 in patients with severe psoriasis (17.78%); 58 cases of MS, including 0

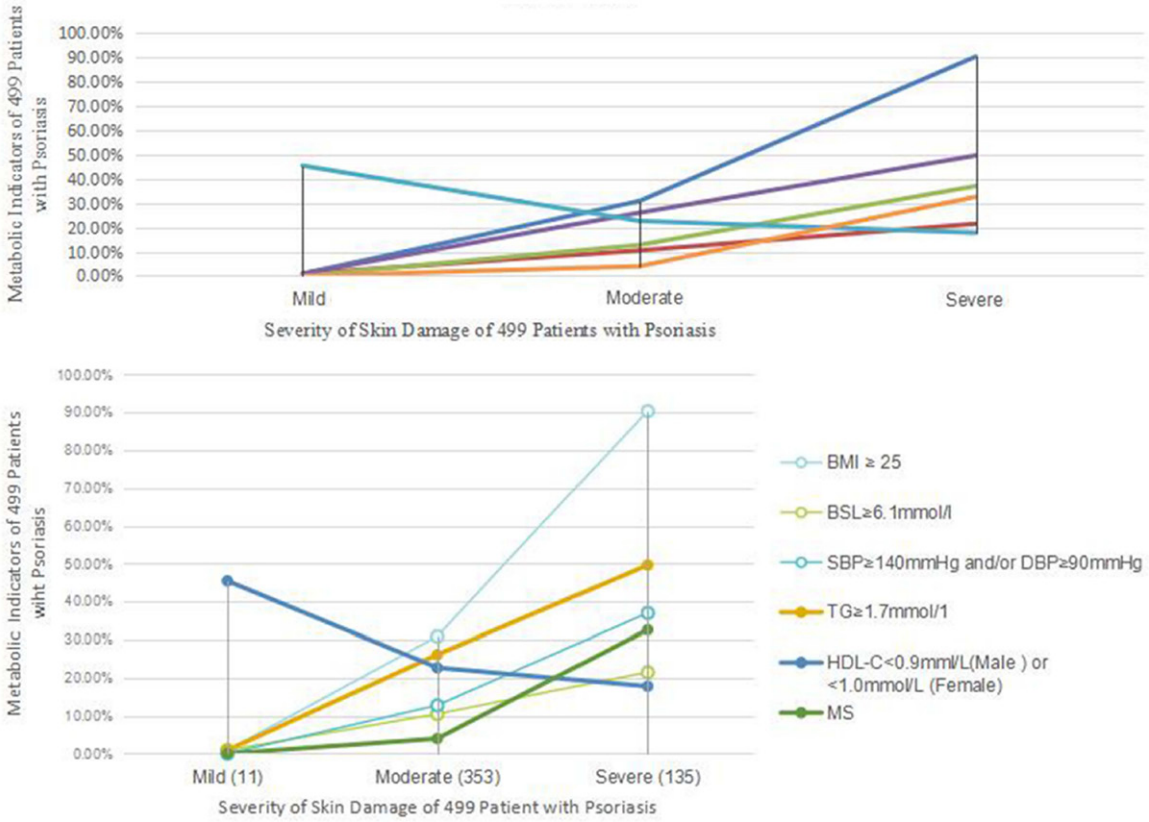

Figure 1. Changes in the number of abnormal metabolic indices cases with the severity of skin damage in 499 patients with psoriasis. Severity of skin damage of 499 patients with psoriasis. Metabolic Indicators of 499 patients.

case in patients with mild psoriasis (0.00%), 14 in patients with moderate psoriasis (3.97%) and 44 in patients with severe psoriasis (32.59%). As psoriasis becomes serious, various metabolic indices rise proportionally, except for HDLL, which decreases as it is a helpful protein rising to represent a healthy body, which indicates a positive relationship between the probability of MS and the severity of psoriasis.

The severity of skin damage is another key factor positively affecting the LOS and medical expenses

Table 5 has compared the impact of severity of skin damage in patients with psoriasis on their LOS and medical expenses, and found that in the 499 cases, 11 patients with mild psoriasis reported an average LOS of 14.56±9.78 and average medical expenses of RMB 6798.37±1821.11; 353 patients with moderate psoriasis reported an average LOS of 20.23±10.67 and average medical expenses of RMB 8997.12±2002.35; 135 patients with severe psoriasis reported an average LOS of 30.39±5.36 and average medical expenses of RMB 11325.67±1009.29, showing statistical significance and indicating that the average LOS and medical expenses rise ($P < 0.05$) as the psoriasis is worse. The severity of skin damage is another key factor positively affecting the LOS and medical expenses, which may be explained in another way that higher difficulty is expected to treat more severe psoriasis.

Psoriasis with MS will significant increase the difficulty expected to treat psoriasis

Table 6 has compared patients with psoriasis, and psoriasis patients with MS in terms of LOS and medical expenses and found that in the 499 cases, 441 patients with psoriasis reported an average LOS of 32.61±9.73 and average medical expenses of RMB 9356.16±2057.97; 58 psoriasis patients with MS reported an average LOS of 20.23±10.67 and average medical expenses of RMB 12275.86±3332.13 ($P < 0.05$). The occurrence of MS will positively affect the LOS and medical expenses of

Table 5. Comparison between patients with psoriasis and psoriasis patients with MS in LOS and medical expenses according to severity of skin damage

Group ITEM	Number of Patients with Psoriasis (n)		
	Mild	Moderate	Severe
	11	353	135
Average LOS (Day)	14.56±9.78	20.23±10.67	30.39±5.36
t	1.74	10.56	
P	0.08	0.00	
Average medical expenses (RMB Yuan)	6798.37±1821.11	8997.12±2002.35	11325.67±1009.29
t	3.60	12.84	
P	0.00	0.00	

Table 6. Patients with psoriasis, and psoriasis patients with MS

Group	Number of Case (n)	Average LOS (day)	Average Medical Expenses (RMB Yuan)
Patients with psoriasis	441	22.78±16.12	9356.16±2057.97
Psoriasis patients with MS	58	32.61±9.73	12275.86±3332.13
t		4.53	9.33
P		0.00	0.00

patients with psoriasis, which may be explained in another way that psoriasis with MS will significant increase the difficulty expected to treat psoriasis.

Discussion

MS is one of the common complications in patients with psoriasis as in the 499 hospitalized patients with psoriasis, the incidence of MS was 11.62%, higher than that in patients with allergic diseases and healthy individuals in the same period ($P < 0.05$), and consistent with previous reports [8]. In this study, a MS incidence of 11.62% was reported in patients with psoriasis, lower than the results from some domestic studies [9-11] possibly due to following factors: (1) Marked variance from study objects in terms of general information. MS development in patients with psoriasis is closely related to age, gender, condition, familial inheritance, susceptibility and severity of skin damage, which were not established as restrictions on hospitalized patients included in the study; (2) Patients with psoriasis in this study were those who have been hospitalized in the Department of Dermatology of our hospital for TCM treatment that they were seldom administered with western medicines. Different treatments may have different effect on patients with psoriasis in the same course or with the same conditions, which may alter the indigence of psoriasis with MS. (3) Patients were included into the study for a specific period, region and sample size, with their indigence varying possibly from the accurate incidence, or from other studies based on a different specific period, region and sample size.

Though psoriasis with MS is a common disease in clinic, it involves very complicated causes and pathogenesis. In this study, consideration was given to the close relationship with obesity (high BMI), hyperlipoidemia (high LDL and TC, and low HDL), hypertension, cause of disease and severity of skin damage, which is basically consistent with some recent study results [12]. More severe skin damage corresponds to higher prediction factor of IR [13]. Psoriasis is known as a systematic chronic inflammatory disease in which, inflammatory factors of IL17, IL223, and IL22 play a key role. The pathogenesis of MS may be related to IL-17 [14] which is suggested to be a key cell factor in psoriasis patients with MS. Systematic inflammation, reflected by C-reactive protein, interacts with oxidative stress [7], and rises significantly in psoriasis patients with MS, which possibly contributes to the increased cardiovascular risk. Early intervention shall be conducted based on C-reactive protein to avoid cardiovascular incidents [15].

Psoriasis and severity of skin damage may be independent factors leading to MS. A higher incidence ($P < 0.05$) was observed in the obser-

vation group as compared with the control groups 1 and 2. The incidence of MS in patients with psoriasis is positively correlated to the severity of psoriasis, and rises as the PASI score increases. In the 11 patients with mild psoriasis, none suffered from MS; in the 353 patients with moderate psoriasis, 14 MS cases were reported; and in the 135 patients with severe psoriasis, 44 MS cases were reported. As the study objects were hospitalized, there were patients with moderate and severe psoriasis but fewer mild cases and none concurrence of MS, which shall be the restriction of studying hospitalized patients and cause leading to the different results from this study as compared with others. Psoriasis with MS involves complicated mechanism, especially when it develops to a moderate or severe degree. So far, literatures have reported it is related to long-term chronic inflammation, SIRTs deacetylation [14], high level of serum adrenalin [16], and the existence of obese gene [17].

MS results in higher difficulty in treating patients with psoriasis, evidenced by a longer LOS and medical expenses ($P < 0.05$) in psoriasis patients with MS as compared with patients with psoriasis. The severity of psoriasis and the occurrence of MS interact with each other and form a non-virtuous circle. Obesity increases the cardiovascular risk of patients with psoriasis by producing proinflammatory adipocytokines via adipose cells and infiltrating immunity cells, generating negative impact on the severity of psoriasis [18]. Overweight or obese patients with psoriasis may attain a higher sensitivity to ciclosporin and narrow-band UVB against psoriasis by controlling diets and losing weight [19], which also helps to improve the clinical syndromes of patients with arthritic psoriasis, reduce DAI in obese patients, and consolidate sensitivity to drugs in clinical treatment [20], so as to achieve the ultimate goal of shortening treatment period. For psoriasis patients with MS, a longer period is required to achieve the same effects [21].

In conclusion, patients with mild psoriasis are suggested to prevent MS by early screening and proper measures, while patients with moderate and sever psoriasis shall actively cooperate with treatment and control weight if they are also suffering from MS. They shall also do cardiovascular follow-up for metabolic and cardiovascular indices to avoid MS and cardiovascular incidences.

Acknowledgements

Thanks to Ms. Xuefeng G and Yueming W who have done a lot in collecting literature data; to Mengxiang L who was responsible for data statistics; to Yongsheng L and Lifang G who provided data of healthy people, and to Aimin L, Yufu F, Wei Z, Buxin Z and Li W who put forward their suggestions to help improve this paper. This work was supported by Key Scientific Research Projects of Higher Education Institutions in Henan Province (No. 15A320058); Henan Province Traditional Chinese Medicine Scientific Research Project (No. 2016ZY31); Special scientific research projects of the National Traditional Chinese Medicine Clinical Research Base in 2019 (No. 2019JDZX056, No. 2019JDZX038) and National Natural Science Foundation of China (No. 81874471).

Disclosure of conflict of interest

None.

Address correspondence to: Yinglin Cui, Henan Hospital of Traditional Chinese Medicine, No. 6 Dongfeng Road, Jinshui District, Zhengzhou 450002, Henan, China. Tel: +86-0371-60908801, +86-15038058083; E-mail: cuiylui@163.com; Shixiang Hu, Surgical Department, Henan Hospital of Traditional Chinese Medicine, No. 6 Dongfeng Road, Jinshui District, Zhengzhou 450002, Henan, China. Tel: +86-0371-60908806, +86-13939033066; E-mail: shixiang1968hu@163.com

References

[1] Huang G and Coviello A. Clinical update on screening, diagnosis and management of metabolic disorders and cardiovascular risk factors associated with polycystic ovary syndrome. Curr Opin Endocrinol Diabetes Obes 2012; 19: 512-519.

[2] Esteghamati A, Ashraf H, Khalilzadeh O, Zandieh A, Nakhjavani M, Rashidi A, Haghazali M and Asgari F. Optimal cut-off of homeostasis model assessment of insulin resistance (HOMA-IR) for the diagnosis of metabolic syndrome: third national surveillance of risk factors of non-communicable diseases in Iran (SuRFNCD-2007). Nutr Metab (Lond) 2010; 7: 26.

[3] Antoniolli LP, Nedel BL, Pazinato TC, de Andrade Mesquita L and Gerchman F. Accuracy

of insulin resistance indices for metabolic syndrome: a cross-sectional study in adults. Diabetol Metab Syndr 2018; 10: 65.
[4] Fernández-Armenteros JM, Gómez-Arbonés X, Buti-Soler M, Betriu-Bars A, Sanmartin-Novell V, Ortega-Bravo M, Martínez-Alonso M, Garí E, Portero-Otín M and Santamaria-Babi L. Psoriasis, metabolic syndrome and cardiovascular risk factors. A population-based study. J Eur Acad Dermatol Venereol 2019; 33: 128-135.
[5] Yin X, Cheng H, Zhang R, Fan X, Zhou F, Jiang L, Tang X, Chen G, Zuo X and Zheng X. Combined effect of five single nucleotide polymorphisms related to IL23/Th17 pathway in the risk of psoriasis. Immunogenetics 2014; 66: 215-218.
[6] Abuabara K, Lee H and Kimball AB. The effect of systemic psoriasis therapies on the incidence of myocardial infarction: a cohort study. Br J Dermatol 2011; 165: 1066-1073.
[7] Borska L, Kremlacek J, Andrys C, Krejsek J, Hamakova K, Borsky P, Palicka V, Rehacek V, Malkova A and Fiala Z. Systemic inflammation, oxidative damage to nucleic acids, and metabolic syndrome in the pathogenesis of psoriasis. Int J Mol Sci 2017; 18.
[8] Yang YW and Lin HC. Increased risk of psoriasis among patients with schizophrenia: a nationwide population-based study. Br J Dermatol 2012; 166: 899-900.
[9] Kimball AB, Schenfeld J, Accortt NA, Anthony MS, Rothman KJ and Pariser D. Incidence rates of malignancies and hospitalized infectious events in patients with psoriasis with or without treatment and a general population in the U.S.A.: 2005-09. Br J Dermatol 2014; 170: 366-373.
[10] Kuhn T, Kaaks R, Teucher B, Hirche F, Dierkes J, Weikert C, Katzke V, Boeing H, Stangl GI and Buijsse B. Dietary, lifestyle, and genetic determinants of vitamin D status: a cross-sectional analysis from the European prospective investigation into cancer and nutrition (EPIC)-Germany study. Eur J Nutr 2014; 53: 731-741.
[11] Radtke MA, Reich K, Blome C, Rustenbach S, Augustin M. Prevalence and clinical features of psoriatic arthritis and joint complaints in 2009 patients with psoriasis: results of a German national survey. J Eur Acad Dermatol Venereol 2010; 23: 683-691.
[12] Ferdinando LB, Fukumoto PK, Sanches S, Fabricio LHZ and Skare TL. Metabolic syndrome and psoriasis: a study in 97 patients. Rev Assoc Med Bras (1992) 2018; 64: 368-373.
[13] Polic MV, Miskulin M, Smolic M, Kralik K, Miskulin I, Berkovic MC and Curcic IB. Psoriasis severity-a risk factor of insulin resistance independent of metabolic syndrome. Int J Environ Res Public Health 2018; 15: 1486.
[14] Fan X, Yan K, Meng Q, Sun R, Yang X, Yuan D, Li F and Deng H. Abnormal expression of SIRTs in psoriasis: decreased expression of SIRT 1-5 and increased expression of SIRT 6 and 7. Int J Mol Med 2019; 44: 157-171.
[15] Paschoal RS, Silva DA, Cardili RN and Souza CDS. Metabolic syndrome, C-reactive protein and cardiovascular risk in psoriasis patients: a cross-sectional study. An Bras Dermatol 2018; 93: 222-228.
[16] Korkmaz S and Sayilan Ozgun G. Serum adropin levels in psoriasis vulgaris and its relation with metabolic parameters. Turk J Med Sci 2019; 49: 110-115.
[17] Tupikowska-Marzec M, Kolackov K, Zdrojowy-Welna A, Sloka NK, Szepietowski JC and Maj J. The influence of FTO polymorphism rs9939609 on obesity, some clinical features, and disturbance of carbohydrate metabolism in patients with psoriasis. Biomed Res Int 2019; 2019: 7304345.
[18] Yang YW, Chen CS, Chen YH and Lin HC. Psoriasis and pregnancy outcomes: a nationwide population-based study. J Am Acad Dermatol 2011; 64: 71-77.
[19] Gelfand JM and Abuabara K. Diet and weight loss as a treatment for psoriasis. Arch Dermatol 2010; 146: 544-546.
[20] Klingberg E, Bilberg A, Björkman S, Hedberg M, Jacobsson L, Forsblad-D'Elia H, Carlsten H, Eliasson B and Larsson I. Weight loss improves disease activity in patients with psoriatic arthritis and obesity: an interventional study. Arthritis Res Ther 2019; 21: 17.
[21] Rui W, Xiangyu D, Fang X, Long G, Yi Y, Wenjuan W, Tian H, Xiaoning Z, Yong Z, Jianfeng F, Hengjin L and Chengxin L. Metabolic syndrome affects narrow-band UVB phototherapy response in patients with psoriasis. Medicine (Baltimore) 2017; 96: e8677.