SJIF Impact Factor: 6.711

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

ISSN: 2457-0400
Volume: 8.
Issue: 3
Page N. 21-29
Year: 2024

Original Article www.wjahr.com

PSORIASIS AND PULMONARY HYPERTENSION

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Article Received date: 26 December 2023 **Article Revised date:** 16 January 2024 **Article Accepted date:** 06 February 2024

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ABSTRACT

Background: Psoriasis is a common disease affecting around 1-3% of world population and is associated with a number of behavioral and systemic comorbidities such as obesity, diabetes, cardiovascular disease. etc, to see if there is association between psoriasis and pulmonary hypertension this study was conducted. **Patients and methods:** Case control study involved 52 psoriatic patients compared with 52 control group, history was taken regarding age, sex. etc, pulmonary function test was done to both groups with body mass index and echocardiography and the results were compared between the two groups. Psoriasis area and severity index was calculated for each psoriatic patient. Treatment history was assessed specially methotrexate therapy. **Results:** Mean age of patients and control group were $43.9^{+}13.69$ years, $41.56^{+}14.07$, no significant difference between patients and control group regarding age, sex residence, body mass index, ejection fraction, systolic and diastolic blood pressure, blood sugar, deceleration time, E-A ratio and pulmonary function test but there was significant difference regarding pulmonary artery systolic pressure (higher in patient group) specially with increase duration, severity of disease and in patients using methotrexate therapy. **Discussion:** Pulmonary artery systolic pressure is significantly increased in psoriatic patients reflecting that psoriasis may be systemic disease and may be due to that sustained skin inflammation induce secretion of cytokine leading to endothelial dysfunction, vascular inflammation and thrombosis. **Conclusion and recommendation:** Pulmonary artery systolic pressure should be carefully monitored in psoriatic patients specially those on methotrexate therapy.

KEYWORDS: Psoriasis, Pulmonary hypertension.

INTRODUCTION

Psoriasis is a skin disease that is inflammatory and immune-mediated, affecting 1-3% of the global population. Its prevalence varies according on factors such as race, geography, and environmental conditions.[1] Psoriasis has been associated with a number of behavioral and systemic comorbidities, many of these conditions have a similar immunological pathogenesis, comorbidities can be manifested years after onset of psoriasis and frequently seen in severe psoriasis, thus, psoriasis is a systemic disease, prompted by cytokines in all body organs.[2] These comorbidities include, obesity and metabolic syndrome, insulin resistance/type 2 diabetes[3], cardiovascular diseases:[4], hypertension, Multiple studies have shown that people with psoriasis had a greater prevalence of cardiovascular illness, including myocardial infarction, thrombophlebitis, pulmonary embolism, and cerebrovascular disease, as well as a higher mortality rate.[5] It was shown that psoriatic patients had a very high prevalence of nonalcoholic fatty liver disease, which is directly linked to metabolic syndrome and obesity.[6] It has been shown that the prevalence of ulcerative colitis and Crohn's disease is higher in psoriatic individuals than in the general population, raising the prospect of a hereditary connection with chronic inflammation.[7] Patients with psoriasis have an increased chance of acquiring chronic obstructive pulmonary disease.[8] Additionally, it has been reported that vitiligo, SLE, Bullous pemphigoid, dermatitis herpetiformis, pemphigus vulgaris, Hashimoto's thyroiditis, Sjögren's syndrome and linear immunoglobulin A dermatosis are immune-mediated diseases that are linked to psoriasis.[9] Patients with psoriasis are observed to be at higher risk of malignancy, particularly non-melanoma cancer and lymphoproliferative cancers.[10]

Main types of treatment of psoriasis are topical, ultraviolet radiation, systemic and biological agents. Methotrexate is highly valuable in the management the chronic plaque type of psoriasis and is also indicated for the long-term management of severe forms of psoriasis. Methotrexate has many pulmonary adverse reactions such as; alveolitis, pulmonary fibrosis, pneumonia and pneumonitis at any time and at any dose. Pneumonitis often follows weeks to months after starting low-dose oral methotrexate (used for non- malignant disorders), but this adverse reaction can follow short term therapy of intravenous or intrathecal route of higher doses.[11] Other side effects can occur in patient taking methotrexate are loss of appetite, nausea and diarrhea, bone marrow suppression, Liver toxicity and infections.

Definition of pulmonary arterial hypertension stated as a mean pulmonary pressure more than 25 mmHg at rest with a normal pulmonary capillary wedge pressure (equal or less than 15 mmHg) and rule out pulmonary venous hypertension.[12] The majority of pulmonary hypertension diagnoses relate to left sided heart disease or respiratory disease. A series of detrimental cell signaling events that result in pulmonary arterioles' severe structural malformation and functional deterioration are set off by exposure to specific environmental or biological vascular injury mediators. Also many evidences suggest that inflammatory process has an important role in the development of Pulmonary arterial hypertension.[13]

Echocardiogram is one of the initial tests done to assess if pulmonary hypertension is present, right heart catheterization is required for a definitive diagnosis of pulmonary hypertension.

AIM OF THE STUDY

Is to evaluate the prevalence of pulmonary arterial hypertension in psoriatic patients.

PATIENTS AND METHODS

This was case-control study which was conducted to determine the pulmonary artery systolic pressure (PASP) between Psoriatic patients and control and to determine the associations of PASP by patients socio-demographic characteristics, medical history, Pulmonary Function Test (PFT), deceleration time (DT) and E/A.

Fifty-two patients with psoriasis attended the outpatient clinic in Merjan teaching hospital from February 2015 to February 2016 were compared with Fifty-two persons with no chronic diseases or illness that can affect pulmonary artery pressure. Clinical assessment by history and physical examination was obtained for all patients and (name, age, sex, duration of disease, history of previous treatment, and any potential risk factors for pulmonary artery hypertension (PAH) including; hypertension, ischemic heart diseases, respiratory diseases, autoimmune diseases, congenital heart diseases, prior pulmonary embolism, sleep disturbance, drugs history that elevate PASP… etc. Physical examination was done regarding site, size, erythema and thickness of psoriatic plaques in addition to nail or joint involvement

Inclusion criteria

1) Patients older than 18 years old age.
2) Patients were ready physically and psychologically to do study's tests and permission was taken to do tests.

Exclusion criteria

1. Smokers
2. Patients with respiratory diseases by history, examination or by pulmonary function test (PFT).
3. Patients with left side systolic and/or diastolic heart failure, valvular heart diseases
4. Pregnancy.
5. Patients with connective tissue diseases, congenital heart diseases, prior pulmonary embolism, obstructive sleep apnea, and previous medical history of diabetes mellitus, hypertension, ischemic heart disease, liver disease, thyroid diseases and patient with splenectomy.
6. Psoriatic arthritis
7. patients with no tricuspid regurgitation (TR)during echocardiographic examination.

Control group

Fifty-two persons were representing this group; this group had no psoriasis or known chronic illness.

History, physical examination and appropriate tests were done after taking permission, this group was matched with patients regarding age sex and body weight.

The diagnosis of psoriasis based on clinical background. PASI (Psoriasis Area and severity Index) score was used at time of examination to evaluate the disease extent and its severity. PASI score was measured as follows:[14]

Skin Sections

The body of patient is divided into four regions; as the head (H) represent (10% of skin of the person), while patients arms (A) (20%), trunk (T) (30%), legs (L) (40%). Each of these four regions was scored individually.

Severity:(S)

The intensity of erythema, thickness and scaling of the psoriasis were valued as none (0), mild (1), moderate (2), severe (3) or very severe (4).

Area:(A)

The percentage area was assessed in the four regions, in every one region, the area was scored as: nil (0), 1-9% (1), 13-29% (2), 30-49% (3), 50-69% (4), 70-89% (5) or 90-100% (6).

Calculating the Index
When all of the previous scores are completed, then the calculation of the PASI score of each patient was as follows:
Head region: S_{head} x A_{head} x 0.1 = Total head
Arms region: S_{arm} x A_{arms} x 0.2 = Total arms
Trunk region: S_{trunk} x A_{trunk}x 0.3 = Total body trunk
Legs region: S_{legs} x A_{legs} x 0.4 = Total legs

Finally, the PASI score equal to summation of total head+total arms+total body trunk+total legs.

Accordingly, the PASI score ranged from 0 to 72. A PASI-score less than 7 was defined as mild, while more than 12 as severe disease.[15]

By single experienced echocardiographic examiner, the echocardiographic study was done at rest while the patient at left lateral position, by means of echocardiographic device (Philips) with a transducer (3 MHz) frequency. PASP was estimated from tricuspid regurgitation flow applying apical four-chamber view, and by using Doppler continuous wave, the maximum TRV was measured. By using a modified Bernoulli equation right ventricular systolic pressure (RVSP)was estimated as:

RVSP = 4v2 + right atrial pressure; *v* = tricuspid jet velocity in meters per second) and is supposed equal to the PASP when the pulmonary valve is normal.

According to the European Society of Cardiology (ESC) and the European Respiratory Society (ERS) for the diagnosis and treatment of pulmonary hypertension PH, PH diagnosis considered as follow: -
(**1**) Pulmonary hypertension is unlikely for TRV ≤ 2.8 m/sec, SPAP ≤ 36 mm Hg (assuming RAP of 5 mm Hg), and no additional echocardiographic signs of PH.
(**2**) Pulmonary hypertension is possible for TRV ≤ 2.8 m/sec and SPAP ≤ 36 mm Hg but the presence of additional echocardiographic signs of PH or TRV of 2.9 to 3.4 m/sec and SPAP of 37 to 50 mm Hg with or without additional signs of PH.
(**3**) Pulmonary hypertension is likely for TRV > 3.4 m/sec and SPAP > 50 mm Hg with or without additional signs of PH.[16]

Several additional echocardiographic signs are proposed in addition to criteria based on TRV.[16]

Table 2-1: Echocardiographic signs suggesting PH used to assess the probability of PH in addition to TRV measurements.

A: **the ventricles**	B:**pulmonary artery**	C: **Inferior vena cava and Right atrium**
Right ventricle / left ventricle basal diameter ratio >1	Early diastolic pulmonary regurgitation velocity>2.2 m/s	Inferior vena cava > 21 mm with decrease inspiratory collapse
Flattening of the interventricular septum	Pulmonary artery diameter>25 mm	Right atrium area >18 mm^2

At least two signs of different categories should be present to alter the probability of PH.
Right atrial pressure (RAP) was estimated by echocardiography based on the diameter and respiratory variation in diameter of the inferior vena cava (IVC):If an IVC diameter ≤ 2.1 cm that collapses >50% with a sniff suggests a normal RA pressure of 3 mmHg (range 0–5 mmHg), while if an IVC diameter >2.1 cm that collapses <50% with a sniff or 20% on quiet inspiration proposes right atrium pressure range 10–20 mmHg. If the IVC diameter and collapse do not fit this paradigm, an intermediate estimation of 8 mmHg (range 5–10 mmHg) is used.[17] Four of patients, 10 mmHg RAP was added other than 5mmhg. Two patients whom PASP ≤ 36 mmHg had additional echocardiographic criteria (RV/LV basal diameter more than 1 and IVC criteria applied) placed them at possible PH category.

Ejection fraction(EF): percent of total blood pushed out left ventricle with each heart beat was calculated by measure left ventricular diastolic dimension (LVDD) and left ventricular systolic dimension (LVSD) M mode in long axis view normal ejection fraction range assumed as range (50%-70%).[18]
EF = LVDD - LVSD / LVDD formula was used to calculate EF.

Early diastolic flow (*E*), atrial contraction signal (*A*), *E*/*A* ratio and deceleration time (DT) were measured by using M-mode and pulsed Doppler sampling echocardiography, Below are normal values for (*A*), E/*A ratio* and (*E*) according to age.[19]

Table 2.2: Normal values for Doppler-derived diastolic measurements.

Measurements	**Age group (y)**			
	16–20	**21–40**	**41–60**	**> 60**
IVRT (ms)	(32–68)	(51–83)	(60–88)	(73–101)
E/A ratio	(0.98–2.78)	(0.73–2.33)	(0.78–1.78)	(0.6–1.32)
DT (ms)	(104–180)	(138–194)	(143–219)	(142–258)

Spirometry: was used to assess pulmonary function test (PFT), by using Spiro lab 3 S/N305130it in Merjan teaching hospital to exclude abnormal PFT.

Body weight scale: weights of patients were taken by specific device. The body mass index (BMI) = weight in kg divided by (height in meter)^2 where the height of patients was measured by using specific ruler in the same weight scale.

Data Analysis

The statistical study has been conducted by using of Statistical Package of Social Sciences (SPSS 20). Continuous variables were presented as mean ± standard deviation. Categorical variables were presented as frequency and percentages. Independent sample t-test was used to compare between two continuous variables. One Way Analysis of Variance (ANOVA) was used to compare between more than two continuous variables. Pearson's (X^2) test has been done to find the association of two categorical variables. P value of ≤ 0.05 was considered as significant.

RESULTS

1: Distribution of Psoriatic Patients and Control by Socio-Demographic Characteristics

The overall mean age of patients and control were (43.90±13.69) and (41.56±14.07) years, respectively. (38.5%) and (36.5%) of patients and control were aged older than 50 years (Figure 3.1).

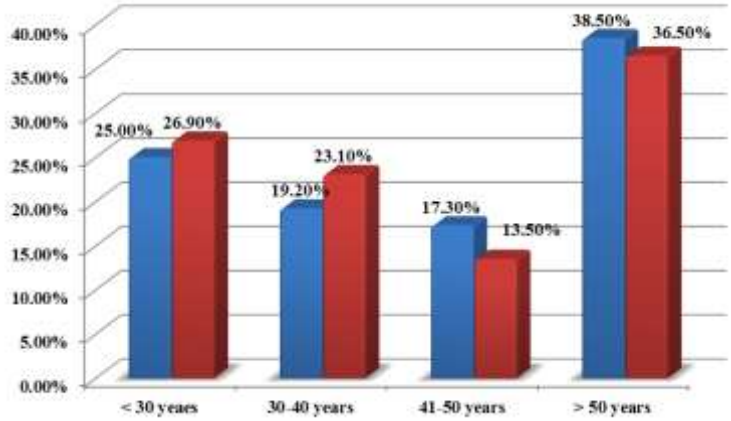

Figure 1: Distribution of psoriatic patients and control by age groups.

Table 3.1 shows the distribution of psoriatic patients and control by sex, marital status, residence, educational levels and occupational status. There were no significant differences of patients and control socio-demographic characteristics.

Table 1: Differences of psoriatic patients and control by sex, residence and occupational status.

Variable	Study groups		χ^2	*P* values
	Patients (%)	Control (%)		
Sex				
Male	29 (55.8)	33 (63.5)	0.639	0.424
Female	23 (44.2)	19 (36.5)		
Residence				
Urban area	25 (48.1)	32 (61.5)	1.902	0.168
Rural area	27 (51.9)	20 (38.5)		

*p value ≤ 0.05 is significant

Table 2 shows the comparison of medical parameters by study groups. There were no significant mean differences of medical parameters by psoriatic patients and control.

Table: Comparison of Medical parameters between Study Groups.

Variable	Study groups	Mean	S.D	t-test	p value
BMI	Patients	25.46	3.41	1.420	0.145
	Control	25.14	4.23		
EF	Patients	57.15	6.44	0.030	0.976
	Control	57.11	6.66		
DBP	Patients	75.61	4.92	1.118	0.068
	Control	76.46	3.90		

SBP	Patients	114.05	6.93	1.383	0.081
	Control	118.28	6.50		
RBS	Patients	4.43	0.593	0.049	0.961
	Control	4.44	0.59		

*p value ≤ 0.05 is significant

Table 3.3 shows the comparison of DT and E/A by study groups. There were no significant mean differences of DT and E/A by psoriatic patients and control.

Table 3: Comparison of DT and E/A by Study Groups.

Variable	Study groups	Mean	S.D	t-test	p value
DT	Patients	165.03	22.41	0.125	0.901
	Control	165.57	21.60		
E/A	Patients	1.15	0.33	1.846	0.068
	Control	1.26	0.31		

*p value ≤ 0.05 is significant

Table 4 shows the comparison of Respiratory Function Test by study groups. There was no significant mean differences of Respiratory Function Test by psoriatic patients and control.

Table 4: Comparison of pulmonary Function Test between Study Groups.

Variable	Study group	Mean	S.D	t-test	p value
FEV1FVC	Patients	83.00	4.08	0.038	0.970
	Control	83.03	3.73		
FVC	Patients	3.71	0.69	0.864	0.389
	Control	3.82	0.64		
FEV1	Patients	3.09	0.62	0.970	0.335
	Control	3.21	0.61		

*p value ≤ 0.05 is significant

Table 5 shows the comparison of PASP by study groups. There was significant difference of PASP by psoriatic patients and control.

Table 5: Comparison of PASP between Study Groups.

Variable	Study groups		χ^2	*P* values
	Patients (%)	Control (%)		
PASP				
Unlikely	41 (78.8)	49 (94.2)	**6.542**	**0.028*[a]**
Possible	6 (11.5)	3 (5.8)		
Likely	5 (9.6)	0 (0.0)		

*p value ≤ 0.05 is significant

Table 6 shows the Distribution of Disease Duration, MTX and PASI among Psoriatic Patients. The mean disease duration was (9.04±5.70) years. Meanwhile, the PASI was (13.29±8.75) among psoriatic patients. The mean MTX was (0.66±1.13).

Table 6: Distribution of Disease Duration, MTX and PASI among Psoriatic Patients.

Variable	Mean± SD
Disease duration	9.04±5.70
PASI	13.29±8.75
MTX	0.66±1.13

Table 7 shows the association of PASP by socio-demographic characteristics. There were no significant associations of PASP by socio-demographic characteristics.

Table 7: Association of PASP by Socio-Demographic Characteristics.

Variable	PASP			χ^2	*P* values
	Unlikely (%)	Possible (%)	Likely (%)		
Age group					
< 30 years	13 (31.7)	0 (0.0)	0 (0.0)		
30-40 years	8 (19.5)	2 (33.3)	0 (0.0)	7.097	0.228
41-50 years	6 (14.6)	1 (16.7)	2 (40.0)		
> 50 years	14 (34.1)	3 (50.0)	3 (60.0)		
Sex					
Male	21 (51.2)	5 (83.3)	3 (60.0)	2.129	0.419

Female	20 (48.8)	1 (16.7)	2 (40.0)		
Residence **Urban area** **Rural area**	 20 (48.8) 21 (51.2)	 2 (33.3) 4 (66.7)	 3 (60.0) 2 (40.0)	0.815	0.665
Occupational status **Employed** **Non-Employed**	 10 (24.4) 31 (75.6)	 1 (16.7) 5 (83.3)	 1 (20.0) 4 (80.0)	0.247	1.000

*p value ≤ 0.05 is significant

Table 3.8 shows the Mean Differences of Respiratory Function Test by PASP. There was no significant Mean Differences of Respiratory Function Test by PASP.

Table 8: Mean Differences of Respiratory Function Test by PASP.

Respiratory Function Test	PASP	N	Mean	S.D	ANOVA	P value
FEV1/FVC	Unlikely	41	83.02	4.02	1.995	0.147
	Possible	6	85.15	2.43		
	Likely	5	80.30	5.26		
	Total	52	83.00	4.08		
FVC	Unlikely	41	3.65	0.63	0.829	0.442
	Possible	6	4.05	0.86		
	Likely	5	3.71	0.94		
	Total	52	3.71	0.69		
FEV1	Unlikely	41	3.05	0.59	1.140	0.328
	Possible	6	3.45	0.72		
	Likely	5	2.97	0.76		
	Total	52	3.09	0.62		

*p value ≤ 0.05 is significant

Table 9 shows the Mean Differences of Patients' Medical History by PASP. There was no significant Mean Differences of Patients' Medical History by PASP.

Table 9: Mean Differences of Patients' Medical parameters by PASP.

Medical history	PASP	N	Mean	S.D	ANOVA	p value
BMI	Unlikely	41	25.18	3.38	1.781	0.179
	Possible	6	25.13	2.73		
	Likely	5	28.16	3.83		
	Total	52	25.46	3.41		
EF	Unlikely	41	58.14	6.64	2.432	0.098
	Possible	6	53.33	5.16		
	Likely	5	53.60	2.50		
	Total	52	57.15	6.44		
DBP	Unlikely	41	74.68	4.64	0.360	0.700
	Possible	6	75.50	3.93		
	Likely	5	73.00	8.36		
	Total	52	74.61	4.92		
SBP	Unlikely	41	114.36	6.73	0.230	0.795
	Possible	6	112.33	7.52		
	Likely	5	113.60	9.07		
	Total	52	114.05	6.93		
RBS	Unlikely	41	4.41	0.61	0.165	0.849
	Possible	6	4.56	0.54		
	Likely	5	4.40	0.55		
	Total	52	4.43	0.59		

*p value ≤ 0.05 is significant

Table 10 shows the Mean Differences of DT and E/A by PASP. There was no significant Mean Differences of DT and E/A by PASP.

Table 10: Mean Differences of DT and E/A by PASP.

	PASP	N	Mean	S.D	ANOVA	p value
DT	Unlikely	41	162.26	22.08	1.547	0.223
	Possible	6	177.00	18.15		
	Likely	5	173.40	27.19		
	Total	52	165.03	22.41		
E/A	Unlikely	41	1.15	0.35	0.026	0.974
	Possible	6	1.16	0.33		
	Likely	5	1.12	0.28		
	Total	52	1.15	0.33		

*p value ≤ 0.05 is significant

Table 11 shows the Mean Differences of Disease Duration, PASI and MTX by PASP. There were significant Mean Differences of Disease Duration, PASI and MTX by PASP.

Table 11: Mean Differences of Disease Duration, PASI and MTX by PASP.

	PASP	N	Mean	S.D	ANOVA	p value
Disease duration	Unlikely	41	8.19	5.48	**4.253**	**0.020***
	Possible	6	9.33	3.20		
	Likely	5	15.60	6.26		
	Total	52	9.03	5.69		
PASI	Unlikely	41	10.92	7.61	**9.382**	**<0.001***
	Possible	6	22.33	9.22		
	Likely	5	21.80	4.43		
	Total	52	13.28	8.75		
MTX	Unlikely	41	.43	.94	**4.325**	**0.019***
	Possible	6	1.43	1.41		
	Likely	5	1.58	1.57		
	Total	52	.66	1.13		

*p value ≤ 0.05 is significant

DISCUSSION

Psoriasis is associated with numerous comorbidities that have a major impact on affected patients. As result achieved from this study, increased frequency of PAH in psoriatic patients denotes that psoriasis possibly is a systemic condition.

The overall mean ages of patients with psoriasis were (43.90±13.69) this is consistent with study referred that psoriasis had two peaks of ages, First between the ages 30 and 39 years and another between the ages of 50 and 69 years.[20]

There was no significant difference in the prevalence of psoriasis between male and female. This result is consistent with other study which shows that women and men are equally affected by this condition.[21]

Although another study shows that both obesity and overweight have been associated with psoriatic patient[7] but this study showed that prevalence of psoriasis was slightly more in over weight in comparison to control but not to significant degree (p value equal 0.145).

Also current study results showed no significant difference between EF, SBP, DBP, RBS, DT and E/A p value was > 0.05 in psoriatic patients because the selected patients in this study were not hypertensive or diabetic or heart failure, inconsistently with other study that showed significant cardiovascular compromise in patient with psoriasis.[11]

Another finding of this study that FEV1/FVC was slightly less in psoriatic patients than control but not significant p value equal 0. 970. This is consistent with other study that shows decline in pulmonary function in patient taken methotrexate for psoriasis.[22]

PAH causes a progressive heighten in resistance pulmonary vessels leading eventually to right ventricular overload and then to right ventricular dysfunction and premature death.[23]

In this study PASP was significantly higher in patients with psoriasis than control sample (p value equal 0.028). This result consistent with result of study done by Yilmaz Gunes, et al who finds also significant increase in the frequency of PAH in case control study including forty seven psoriatic patients compared with control sample.(p value was 0.001).

In this study PASP was correlated with increase body weight and age but not to significant degree (p value >0.05) this consistent with result of study that reveals that PASP is affected by age and body mass index and may be as high as 40 mmHg in older (age more than 50

years) particularly if patient has diabetes mellitus or obese (body mass index more than 30 kg/m2).[24] But there is no significant difference in PASP with gender.

Raised BMI may be a risk factor for both the development of psoriasis and PAH.[25]

Also this study showed that PASP was significantly correlated with severity of psoriasis according to PASI score, duration of disease, methotrxate taken (p value was <0.001, 0.020, 0.019 respectively).

A possible link between methotrexate and lung disease is that a chronic, progressive lung fibrosis has been described in the setting of methotrexate therapy.[11]

In addition, other study finds that prevalence of cardiovascular diseases is increased compared to the general population in individuals with moderate-to-severe psoriasis.[4]

A crucial role for inflammation in the development of pulmonary hypertension, specifically PAH, is being suggested by an increasing number of research.[13] The higher frequency of PAH in individuals with a range of inflammatory conditions suggests that the inflammatory and immunological processes play a significant part in the disease's etiology.[26] Systemic involvement may arise due to the systemic nature of the inflammatory processes that underlie the pathophysiology of psoriasis.

So both psoriasis and pulmonary hypertension share the underlying inflammatory mechanism, that may result in elevated PASP.

Prolonged skin inflammation in psoriasis is enough to cause subcutaneous fat cells, endothelial cells, and other inflammatory cells to secrete cytokines, which can cause endothelial dysfunction, vascular inflammation, and thrombosis.[27] Endothelial cell dysfunction that occurs in PAH results in over production thromboxane A2[28], so thrombosis can occur in psoriasis and PAH and may play important role in increase PASP. Also it was found that patients with psoriasis had higher prevalence of cardiovascular diseases, such as myocardial infarction, thrombophlebitis, pulmonary embolism and an increased mortality.[11] Increased levels of inflammatory cytokines and acute phase reactants have been associated with low-grade inflammation and the risk of atherosclerosis in psoriasis.

An important mechanism in pathophysiology of PAH is increased pro coagulant activity and platelet activation in psoriasis.[29]

Also evidence of association of psoriasis and pulmonary hypertension with autoimmune diseases such as rheumatoid arthritis, systemic lupus erythematous, thyroid disease reflect the autoimmune base of these diseases.[30]

Limitation

Small number of patients is the major limitation in addition that not all patient with pulmonary hypertension had TR. TRV may be greatly underestimated in patients with severe tricuspid regurgitation and is not a reliable indicator of PH. Plus, overestimation can happen. TRV cut-off value cannot define PH with any degree of reliability.

CONCLUSIONS

Due to the higher incidence of pulmonary hypertension, patients with psoriasis should have their pulmonary artery systolic pressure checked more closely. PASP should be monitored in psoriatic patients treated with methotrxate and those with long standing and severe disease.

Recommendation

1) To increase number of patients.
2) Further investigations to confirm exclusion criteria and secondary causes of pulmonary hypertension.
3) Serial echocardiographic examinations may be helpful because PAH may have a gradual progression and subtle onset, making early detection of symptoms challenging.

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