Journal of Pakistan Association of Dermatologists 2008; **18**: 132-137.

Original Article

Hemoglobin content and sedimentation properties of erythrocytes in psoriasis

Doulat Rai Bajaj*, Shah Muhammad Mahesar, Muhammad Hanif Ghani†**

Departments of Dermatology*, Biochemistry** and Medicine†, Liaquat University of Medical & Health Sciences Jamshoro

Abstract ***Objective*** To assess the hemoglobin level and sedimentation characteristics of erythrocytes in patients with psoriasis and compare it with healthy subjects.

Patients and methods It was a cross-sectional study, conducted at Department of Biochemistry Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro in collaboration with Department of Dermatology LUMHS from March, 2007 to December, 2007. 79 consecutive adult patients (ages from 15 years onwards), 44 male and 35 female with various grades of severity of psoriasis were included in study. Similar number of healthy persons of matching ages and sex were included as control. After recording their demographic data blood was analyzed for hemoglobin (Hb) levels, and erythrocyte sedimentation rate (ESR). Similar analysis was done on healthy controls. The results thus obtained were analyzed statistically by using Chi-square test.

Results Statistically significant differences regarding hemoglobin level and sedimentation rate were observed in between patients and healthy controls. Hb% was low (mean in males 12.62 SD 1.27, in females 11.13 SD 1.48, $p \leq 0.001$) as compared to healthy controls (mean in males: 15.28 SD 1.38, in females: 13.67 SD 1.66). ESR was elevated in psoriasis patients (mean 30mm in 1st hr SD 10.37 in males, females 34 mm/1st hr SD 12.21 ($p \leq 0.001$) as compared to normal controls (males 09 mm/1st hour SD 4.16, females 15 mm/1st hour SD 3.52).

Conclusion Psoriasis is associated with systemic inflammatory response with changes in hemoglobin level and properties of erythrocytes.

Key words
Psoriasis, hemoglobin level, ESR, erythrocytes, oxidative damage

Introduction

Psoriasis is an autoimmune disease characterized by inflammatory lesions on skin. It presents with erythematous plaques of various sizes on body. Scaling is a conspicuous feature of disease.[1] It incurs significant burden on the social and financial state of patients even if not extensive.[2]

It affects about 2-3% of world population. According to world psoriasis day consortium about 125 million people all over the world suffer from psoriasis.[3]

Psoriasis is a T cell-mediated disease involving CD4 and CD8 lymphocytes.[4] These cells, upon encounter with an antigen

Address for correspondence
Dr. Doulat Rai Bajaj,
Associate Professor, Department of Dermatology
Liaquat University of Medical & Health Sciences
Jamshoro
Phone: + 92223008708, +923003076504
E-mail: doulat01@yahoo.com

become activated and migrate to skin where they release a plethora of cytokines.[5] These include TNF-∞, IFN-ϒ and IL-2 (Th1 cytokines), that initiate and perpetuate inflammatory response in skin.[6] There is proliferation and accumulation of monocytes and macrophages in blood and tissues.[7] The monocytes and macrophages release oxygen metabolites and proteases which cause oxidative and proteolytic damage to plasma constituents and red blood cells. The heme biosynthetic capacity of red blood cells is decreased.[8] A genetically determined defect in synthesis of globins chains leading to increased production of hemoglobin A2 has been proposed by Zlatkov.[9] All these factors contribute to decreased number of erythrocytes.[10]

Erythrocyte sedimentation rate (ESR) also known as Biernacki reaction is a measure of inflammatory activity in body.[11] It depends upon the fibrinogen content of plasma and the shape and surface properties of erythrocytes e.g. the negative charge of erythrocytes. It is raised in chronic inflammatory, granulomatous, degenerative and malignant diseases.[12] Therefore its deregulation in psoriasis are anticipated. In psoriasis plasma albumin decreases while the globulins and fibrinogen levels increase.[13] The surface properties of erythrocytes are also altered with significant decrease of erythrocyte deformability.[14] These changes in erythrocyte morphology and plasma characteristics are responsible for increased sedimentation of RBC.

The correction of these blood abnormalities is also vital while treating a patient with psoriasis. There has been no study on this subject in our country. The study was conducted to assess the profile of these abnormalities in our population and enhance the understanding of pathogenesis and better planning of treatment strategies in these patients.

Patients and methods

Study population A total of 79 consecutive patients with psoriasis (44 male and 35 female) attending Department of Dermatology, Liaquat University Hospital, for treatment purpose from March, 2007 to December, 2007 were enrolled in study. An informed consent was sought from them and their biodata entered into pre-structured standard pro forma. Similar number of age and sex-matched healthy subjects was included in study for control purpose. The subjects for control group were taken from paramedical staff, healthy volunteers and patients attending skin out patient department for cosmetic problems like acne, pigment disturbances. Patients with all clinical forms and severity of psoriasis such as plaque, hyperkeratotic, palmoplantar, nail, scalp and flexural were included in study. We divided patients into three broad groups according to severity of disease. Patients with less than 30% body involvement were graded as mild, 30-50% as moderate and those having more than 50% involvement of body surface as severe. The patients with erythrodermic and pustular forms were not included because of systemic involvement in these forms.

Inclusion criteria All patients with psoriasis from ages 15 onwards.

Exclusion criteria Patients having other concomitant acute or chronic disease such as bacterial or viral infections, autoimmune, granulomatous or neoplastic diseases were excluded from study. Smokers and alcoholics were also excluded.

Clinical assessment Patients were assessed clinically by history and physical examination. A short history regarding onset, duration, severity of disease, drug and family history was elicited from patients followed by brief cutaneous and systemic examination. This included location, severity of erythema, amount of scaling and thickness of psoriatic plaques.

Systemic examination This was conducted by qualified physician to exclude any systemic disease that would act as confounding variable.

Methodology After recording above parameters, 5 ml of venous blood was drawn into a clear sterile syringe and submitted to laboratory for determination of hemoglobin level and erythrocyte sedimentation rate.

The hemoglobin concentration was determined by the hemoglobin cyanide method which is the photometric determination of total hemoglobin in the form of hemoglobin cyanide. It is the method of choice.[13,14]

The ESR determination was done by standard Westergren method. 1.6 ml of blood was mixed with 0.4 ml of sodium citrate in a clean test tube. After gentle shaking (avoiding foaming), it was sucked up into a Westergren pipette up to the 0 mark. The pipette was kept upright in a Westergreen rack and left to stand at room temperature. The sedimentation value was read after 60 min.

Results

Seventy nine consecutive patients were enrolled in study. Their ages ranged from 15 to 68 years with a mean age of 41 years. Among them, 44 were males and 35 were females. All were suffering from various grades of psoriasis. Family history of psoriasis was positive in 8 (24%) patients. The majority of patients (n= 74, 85%) in our study had plaque type psoriasis, 5 (6%) had in addition scalp and nail involvement, 2 (2.27%) had guttate lesions, 4 (4.54%) had palmoplantar lesions while remaining 3 (3.4%) comprised of hyperkeratotic and flexural psoriasis. The proportion of patients according to severity was as follows: 53 (67.1%) patients had moderate degree of psoriasis, 17 (21.5%) mild and remaining 9 (11.4%) had severe psoriasis. History of seasonal variation of disease was positive in 36 (40.44%) patients. Out of these 24 (66%) noticed exacerbation of disease in winter while 12 (34%) in summer season.

The mean hemoglobin level in psoriatic males was 12.62±1.27 g/dl as opposed to 15.28±1.38 g/dl in healthy male controls. The mean hemoglobin level in psoriatic females was 11.13±1.48 g/dl as opposed to 13.67±1.66 g/dl in healthy females.

The mean ESR in psoriatic males was 30.20±10.37 mm as opposed to 9.54±4.17 mm in their control counterparts. On the other hand mean ESR in psoriatic females was 34.02±12.21 mm as opposed to 14.8±3.52 mm in healthy females.

Table 1 Data of hemoglobin concentration in psoriatic patients and controls.

Gender	Group	Number of Patients	Mean Hb (g%)	Standard deviation	Mean St. Error	*P* value
A. Male	Psoriatic	44	12.62	1.27	0.19	≤ 0.001
	Control	44	15.28	1.38	0.20	
B. Female	Psoriatic	35	11.13	1.48	0.25	≤ 0.001
	Control	35	13.67	1.66	0.27	

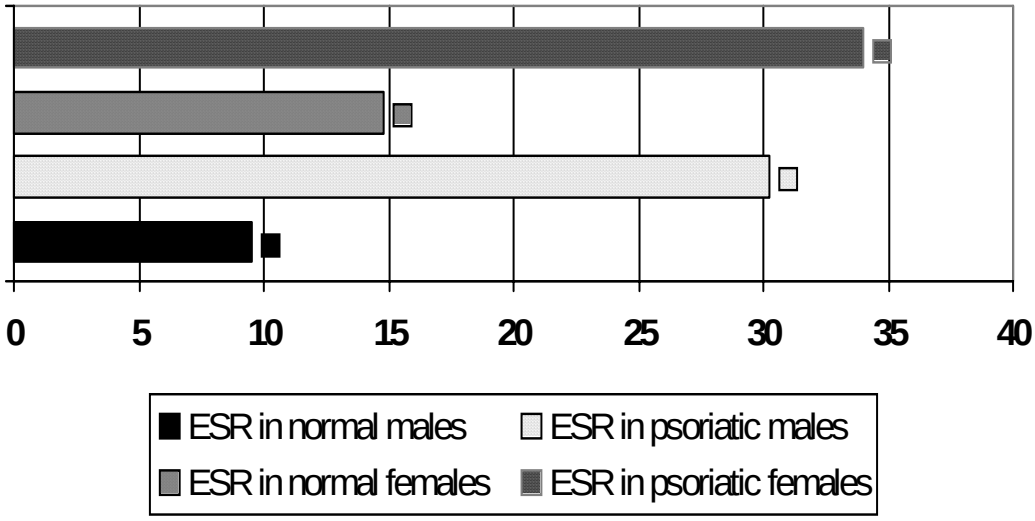

Figure 1 ESR in psoriatic patients and healthy controls.

The results are shown in **Table 1** and **Figure 1**.

Discussion

The pathological effects of psoriasis on the structural and functional characteristics of erythrocytes are known since long. These include reduction in the antioxidant defenses and membrane fluidity with ultimate fall in their sedimentation.[10] The activity of antioxidant enzymes super oxide, dismutase and catalase is decreased with resultant increase in levels of malondialdehyde (MDA) in erythrocytes.[15] There is increased membrane lipid peroxidation, membrane-bound hemoglobin content, osmotic fragility and reticulocyte count, with a different band 3 profile.[16] Most of these modifications are found to be enhanced in severe psoriasis. A defect in globin chains leads to increased production of fetal hemoglobin.[9] The sum of all these pathological changes in erythrocytes is expressed clinically in the form of decreased hemoglobin levels and reduced life span of erythrocytes.

On the other hand a deficiency of cyclic adenosine monophosphate (cAMP)-dependent protein kinases (PKA), the intracellular mediator of cAMP coupled with decreased deformability of erythrocytes may be responsible for their increased tendency to rouleaux formation in psoriasis.[17]

There is sparseness of data regarding clinical effects of these pathological changes in

erythrocytes. The purpose of our study was to assess the clinical outcome of these changes.

It is evident from our study that significant clinical changes occur in psoriasis. The hemoglobin content of RBCs is significantly reduced. It was approximately 2-3 g/dl less in psoriatic patients as compared to controls. This results into clinically detectable anemia. There may be other effects contributing to anemia such as chronic and continuous loss of iron through scaling, deficient nutrition, less absorption through gut and bone marrow depression due to chronic inflammatory process.

Similarly a 2-3 fold rise in the rate of sedimentation of erythrocytes was noted in our study. This may have resulted again from multiple factors such as increased fibrinogen content of plasma, altered albumin globulin ratio due to continuous loss of albumin from skin, less supply in food and protein loosing enteropathy due to concomitant inflammation of gut mucosa and a variety of structural changes in erythrocytes discussed above.[18]

A direct relationship was found between severity of disease and these clinical changes. The patients with severe disease had more decreased hemoglobin level and highly increased ESR, while the patients with less severe disease had opposite results. Therefore the changes in hemoglobin levels and ESR reflect the severity of inflammation in psoriasis and its systemic effects.

We were not able to compare the data of our study with any other as we could not find such work done before.

We conclude from this study that significant damage occurs to red blood cells in psoriasis with resulting anemia and increased ESR. These effects would lead to decreased oxygenation of vital organs and tissues of body with deleterious effects. Therefore, appreciation and correction of these blood changes is important in psoriasis.

References

1. Christopher E, Kruger G. Psoriasis. In: Fitzpatrick TB, Eisen AZ, Wolff K, *et al,* editors. *Dermatology in General Medicine, 3rd edn.* New York: McGraw-Hill; 1987. p. 465-81.
2. Stern RS, Nijsten T, Feldman SR *et al*. Psoriasis is common, carries a substantial burden even when not extensive, and is associated with widespread treatment dissatisfaction. *J Invest Dermatol Symp Proc* 2004; **9**: 136-9.
3. Gelfand JM, Stern RS, Nijsten T *et al.* The prevalence of psoriasis in African Americans: results from a population-based study. *J Am Acad Dermatol* 2005; **52**: 23-6.
4. About psoriasis. National Psoriasis Foundation [Internet]. c2007 [Cited 2007 Dec 10]. Available from: www.psoriasis.org
5. Berridge MJ. Lymphocyte activation in health and disease. *Crit Rev Immunol* 1997; **17**: 155-78.
6. Aringer M. T-lymphocyte activation – an inside overview. *Acta Med Austricia* 2002; **29**: 7-13.
7. Stephanic L, Mehlis MD, Kenneth B, Gordon MD. The immunology of psoriasis and biologic immunotherapy. *J Am Acad Dermatol* 2003; **49**: S44-50.
8. Rocha-Pereira P, Santos-Silva A, Rebelo I *et al.* The inflammatory response in mild and in severe psoriasis. *Br J Dermatol* 2004; **150**: 917-28.
9. Zlatkov N, Damianova L, Prodanov K, Kiriakova N. Hemoglobin A2 and F in patients with psoriasis. *Dermatol Monatsschr* 1990; **176**: 403-6.

10. Rocha-Pereira P, Santos-Silva A, Rebelo I *et al.* Erythrocyte damage in mild and severe psoriasis. *Br J Dermatol* 2004; **150**: 232-44.
11. Van Kamp E.J, Standardization of hemoglobinometry: II. The hemoglobincyanide method. *Clin Chim Acta* 1961; **6:** 538-42.
12. Cannon RK. Proposal for a certified standard for use in hemoglobinometry; second and final report. *Clin Chem* 1958; **4**: 246-51.
13. Bhatnagar M, Bapna A, Khare AK. Serum proteins, trace metals and phosphatases in psoriasis. *Indian J Dermatol Venereol Leprol* 1994; **60**: 18-21.
14. Gornicki A. Changes in erythrocyte microrheology in patients with psoriasis. *Clin Exp Dermatol* 2004; **29:** 67-70.
15. Thérond P, Gerbaud P, Dimon S *et al.* Antioxidant enzymes in psoriatic fibroblasts and erythrocytes. *J Invest Dermatol* 1996; **106**, 1325-31.
16. Drewa G, Krzyzyńska-Malinowska E, Woźniak A *et al.* Activity of superoxide dismutase and catalase and the level of lipid peroxidation products reactive with TBA in patients with psoriasis. *Med Sci Monit* 2002; **8**: 338-43.
17. Raynaud F., Gerbaud P, Bouloc A *et al*. Rapid effect of treatment of psoriatic erythrocytes with the synthetic retinoid acitretin to increase 8-azido cyclic AMP binding to the RI regulatory subunit. *J Invest Dermatol* 1993; **100**: 77-81.
18. Lee F, Bellary S, Francis C. Increased occurrence of psoriasis in patients with Crohn's disease and their relatives. *Am J Gastroenterol* 1990; **85**: 962-3.

Manuscript Submission

Manuscripts should be sent to the Editor, Dr. Ijaz Hussain,

539-B, Johar Town, Lahore.

E mail: drijazhussain@gmail.com.com,

For PhotoDermDiagnosis contact:

Dr. Amor Khachemoune, MD, SUNNY, Downstate Medical Center,

Brooklyn, NY, USA.

E mail: amorkh@pol.net