International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 15-09-2020; Accepted: 30-09-2020; Published: 16-10-2020
www.medicalsciencejournal.com
Volume 6; Issue 10; 2020; Page No. 22-24

Study of oxidative stress in psoriasis patients: A case control study

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Abstract
Aim: To study oxidative stress in psoriasis patients.
Material and Methods: A total of 50 cases diagnosed for psoriasis were undertaken during the study period in the test group. 50 healthy individuals with no skin disease were taken as control group. The cases were taken from the department of Dermatology. Blood samples were collected and analyzed in the department of Biochemistry, Owaisi Hospital and Research Centre (OHRC).
Results: In this study, serum MDA levels were significantly increased in psoriasis group when compared to controls. Oxidative stress is recognized as important in pathogenesis of psoriasis. Serum FRAP Assay were lowered in psoriasis patients than controls indicating that total antioxidant levels are decreased in psoriasis than controls. Decreased total antioxidant levels may be due to depressed state of antioxidant system or due to oxidative stress in these patients.
Conclusion: This study provides an evidence for increased ROS production and decreased antioxidant defenses in psoriasis.

Keywords: control, pathogenesis, antioxidant, psoriasis

Introduction

Psoriasis is a common, chronic, disfiguring, inflammatory and proliferative condition of the skin with both genetic and environmental influences characterized by red, scaly, sharply, demarcated, indurated plaques, present particularly over extensor surfaces and scalp [1]. The incidence world-wide is 2-3% [2]. In Asians, it is as low as 0.4%.[3] Psoriasis occurs with equal frequency in males and females. The onset of psoriasis constitutes a lifelong threat. Its duration may vary from a few weeks to a whole lifetime. Studies show a bimodal distribution of age of onset with peaks between 16 – 22 and 57 – 60 years.

Different factors involved in the etiopathogenesis of psoriasis are genetic factors, trauma, infection, drugs, sunlight and psychogenic factors. There is an increased keratinocyte proliferation due to an increase in the proliferating cell compartment in the basal and supra basal levels of the epidermis. The number of cycling cells is increased approximately sevenfold. Vertical dermal capillary loops in lesional skin are dilated, elongated and twisted. A fourfold increase in endothelium of superficial but not deep microvasculature indicating that these changes are confined to the upper plexus [4]. The skin is a potential target for oxidative injury, as it is continuously exposed to UV radiation and other environmental stresses generating reactive oxygen species (ROS) [5]. ROS mediated oxidative damage involves a vast number of biological molecules since it causes lipid peroxidation, DNA modification, and secretion of inflammatory cytokines.

The present study was planned to investigate the possible involvement of oxidative stress-antioxidant status in psoriatic patients.

Materials and Methods

A case control study was carried out at Owaisi Hospital and Research Centre (OHRC), Hyderabad. The study was carried out for a period of 1 year from June 2016-June 2017. A total of 50 cases diagnosed for psoriasis were undertaken during the study period in the test group. 50 healthy individuals with no skin disease were taken as control group. The cases were taken from the department of Dermatology. Blood samples were collected and analyzed in the department of Biochemistry, Owaisi Hospital and Research Centre (OHRC). All patients attending the dermatology out-patient department in the Owaisi Hospital and Research Centre (OHRC), who were diagnosed with psoriasis were included in the study. Both male and female patients within the age group of 18-65 years were included. Controls: 50 individuals without history of any kind of skin disease were selected who included both males and females in the age group of 18 to 65 years.

Patients with history of other skin diseases, chronic diseases like hypertension, diabetes, chronic smokers and alcoholics, Psoriatic patients receiving any systemic treatment for at least 4 weeks or photochemotherapy within 3 months before enrolment and patients who did not give voluntary informed consent for reviewing, patients less than 18 years and more than 55 years were exclused from the study.

Approval of the institutional ethics committee was obtained before starting the study.

Sample Collection

Informed consent was taken from all the patients for inclusion into the study group. Under aseptic conditions 5 ml of blood samples were collected by venous puncture into plain dry and properly labeled bottles.

The blood was allowed to stand for 30-40 minutes at room temperature for the clot formation. Then it was centrifuged and serum was collected into screw capped vials. Precautions were taken to prevent hemolysis.

The following parameters were estimated in all subjects

a. Oxidative stress is evaluated as TBARS.

One mole of MDA reacts with 2 moles of TBA to form a pink coloured condensation product which can be measured fluorometrically at excitation 515 nm and emission at 555nm.

Statistical Analysis

SPSS software version 24 was used for the analysis. Student t test (independent, two-tailed) was used for significance of study parameters on a continuous scale between two groups. Pearson's correlation was used to find out the strength of linear relationship between study variables. P-value of 0.05 or less as statistically significant.

Results

There was no statistical difference in patient's demographics between the two groups.Mean age was 43.76 ± 10.080.50 individuals of the age group of 18-55 years without any history of any skin disease or chronic diseases like hypertension, diabetes and obesity were taken as control group in this study Mean age was 38.96 ± 11.178.

Table 1: Showing statistical analysis of serum MDA levels in psoriasis and controls

	Serum MDA levels (nmol/ml)	
	Psoriasis	**Controls**
Mean	434.44	174.44
Standard Deviation	145.613	17.246
P – value	0.00 *S	

*HS = Highly Significant

Serum MDA levels in psoriasis patients are in the range of 434.44±145.61.

Serum MDA levels in controls are in the range of 174.44±17.24. It is evident from the table that serum MDA levels are increased in psoriasis patients when compared to controls. This increase is highly significant (p<0.001).

Graph 1: Showing statistical analysis of serum MDA levels in psoriasis and controls

Discussion

Psoriasis represents the major common dermatosis of multifactorial determination. The fundamental evolutionary biology of environs bearing skin and revelations on multistep involvement of oxidative stress in pathogenic events of psoriasis makes a strong case for medical contemplation. An attempt is made to discuss the multistep pathogenic indulgence of oxidative stress and trace elements to emphasize the worth attention to oxidant-antioxidant status toward rational and desired management of psoriasis. Skin evolved in environment of oxygen which naturally impact [6] processes of development, maturation and death of keratinocytes by continuous exposure to free environment. Oxidative stress induced apoptosis of the granular layer cells results in the formation of defective horny layer (keratinization), the key feature driving skin damage spread and chronicity of the disease.

Although there have been extensive studies on the roles of serum lipids, oxidants and antioxidants levels in psoriasis, their importance in the etiology or in the enhancement of the disease remains controversial (Jyothi *et al*., 2011) [7]. It has been suggested that ROS may play a role in the pathogenesis of psoriasis.

Increased ROS production in patients of psoriasis and decreased concentration of antioxidants leads to oxidative stress, which indicates lipid peroxidation. This may lead to cell damage by continuous chain reactions damaging the cell membranes and tissues. The free radicals induced oxidation of polyunsaturated fatty acids, which results in the formation of lipid peroxidation products such as MDA. Increased ROS production in patients of psoriasis and decreased concentration of antioxidants leads to oxidative stress. ROS may be produced during the inflammatory process, in psoriasis, affecting primarily lipid metabolism of cells. Further, ROS that are produced by lipid peroxidation may activate phospholipase A_2 and thus cause peroxidation of many mediators by arachidonic acid which finally metabolized to MDA.

In the report of kharaevea *et al*. (2009), 58 patients with erythrodermic psoriasis and psoriatic arthropathy showed significant clinical improvement and reduction of oxidative stress after 5 weeks treatment with conventional therapy plus supplementation with antioxidant therapy in the form of coenzyme Q10, vitamin E and selenium. These different results could be explained by the concomitant use of conventional therapy, the different clinical varieties of psoriasis, the large number of patients and the higher doses of antioxidant therapy given in this study [8].

Kadam *et al*. also observed a significant increase in the malondialdehyde levels in psoriasis patients as compared with healthy controls [14]. A study by Relhan *et al*., showing lower plasma malondialdehyde levels in psoriasis patients in remission than during the active phase, also supports the view that oxidative damage plays an important role in etiopathogenesis of psoriasis [12].

In vivo antioxidant status can be assessed by measuring individual plasma or tissue levels of antioxidants. Measuring the levels of these specific antioxidant molecules can yield valuable information, and low levels of such antioxidants provide suggestive, but not definitive, evidence of oxidative stress. However, determining total antioxidant capacity provides an index of the sum of the activities of all antioxidants [10].

In this study we found that, the concentration of plasma FRAP was found to be low in active psoriasis patients than in controls. This decreased concentration of FRAP might either be due to depressed state of antioxidant system or caused as a result of exaggerated inflammatory processes or both. Our study indicates the possibility that, in the pre-diagnostic stage, serum antioxidants are low because they have been used in reducing inflammatory products. Antioxidants prevent oxidative injury of structural lipids and proteins contributing to barrier integrity, which is essential for healthy skin condition. This suggests that cellular redox environment plays a pivotal role in skin homeostasis and

that skin disease could result from an imbalance between pro-oxidant and antioxidant stimuli [11]. We also observed that patients with psoriasis have higher mean serum copper, lower mean serum zinc and lower mean magnesium levels than with controls.

Since antioxidant imbalance is implicated in the pathogenesis of inflammatory skin disease, supplementation of antioxidants appears as a rational approach to restore homeostasis.

Conclusion

In conclusion, this study provides an evidence for increased ROS production and decreased antioxidant defenses in psoriasis, reflected by increased lipid peroxidation and decreased TAS as well as alterations in the levels of trace elements. Thus, early anti-oxidant supplementation and screening for trace elements might be warranted in psoriasis to mitigate the development of oxidative stress and its complications.

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