Comparison of levels of serum copper, zinc, albumin, globulin and alkaline phosphatase in psoriatic patients and controls: A hospital based casecontrol study

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ABSTRACT

Background: Psoriasis is a chronic, immune-mediated skin disease with unknown etiology, with an epidermal turnover time of <10 days compared to a normal turnover time of 4-8 weeks. This epidermal hyperproliferation accounts for many of the metabolic abnormalities including alteration in the serum levels of proteins and some trace elements. **Aim:** The aim was to detect any statistically significant difference in the serum levels of zinc, copper, albumin, globulin and alkaline phosphatase between psoriasis patients and healthy controls. **Materials and Methods:** Hundred cases of psoriasis and 100 age and sex matched controls were enrolled in a hospital based case-control study. The serum levels of zinc, copper, albumin, globulin and alkaline phosphatase were calculated and compared among the cases and controls and evaluated statistically. **Results:** Serum zinc levels were significantly low in the psoriasis group as compared with controls (mean 80.028 μg/dl vs. 109.179 μg/dl, $P < 0.0001$). Serum copper levels were significantly raised among cases as compared with controls (mean 167.317 μg/dl vs. 133.884 μg/dl $P < 0.0001$). Serum albumin levels were significantly decreased (3.762 g/dl vs. 4.103 g/dl, $P < 0.001$), whereas serum globulin levels were raised (3.296 g/dl vs. 2.596 g/dl, $P = 0.0014$) among cases as compared with controls, respectively. Serum alkaline phosphatase levels were comparable between the two groups. **Conclusion:** The results of this study show significant alterations in the serum levels of copper, zinc, albumin, and globulin in psoriatic patients. This paper aims at highlighting the possible role of trace metals copper and zinc in the aetiopathogenesis of psoriasis and also provides a proposed interplay of factors involved in the pathogenesis of psoriasis.

Key words: Psoriasis, serum albumin, serum copper, serum globulin, serum zinc, trace elements

INTRODUCTION

Psoriasis is a chronic, immune mediated skin disease characterized by erythematous plaques covered with a silvery-white scale, predominantly over the extensor surfaces and the scalp. The prevalence of psoriasis varies widely, from 0.6% to 4.8%.[1] Males and females are equally affected by psoriasis vulgaris, with an earlier age of onset in females.[2,3] The precise cause of psoriasis is still unknown. However, there is often a genetic predisposition, and sometimes an obvious environmental trigger such as an infection.

Characteristic cutaneous disorders such as Wilson's disease and Menke's kinky hair disease are caused by abnormal copper metabolism; acrodermatitis enteropathica is caused by zinc deficiency.[4] Some investigators have also reported low serum zinc levels in cutaneous disorders such as acne vulgaris, lichen planus, ichthyosis, etc., Against this background, there is a possibility that abnormal metabolism of both these metals may also exist in psoriasis.

MATERIALS AND METHODS

This was a prospective hospital-based case–control study involving 100 cases of psoriasis aged 18 years and above and 100 age and sex matched healthy controls. Any patient having a disease or condition known to alter the levels of serum proteins, trace elements or alkaline phosphatase or receiving any systemic treatment for psoriasis for at least four weeks before enrolment were excluded.

The cases comprised psoriasis patients attending the inpatient and outpatient departments of a dermatology department at a government-run

medical college. The control group comprised of patients with other unrelated insignificant complaints, attendants of patients and staff members of the hospital. The source population for the cases and controls was the same. Informed consent was taken from both groups, and data was recorded on a standard proforma. Plasma levels of zinc and copper were estimated in both groups in addition to the routine investigations.

The statistical analysis of the data was performed using GraphPad inc. and instat 3 software. The measurements were expressed as mean ± standard deviation (SD). To evaluate the differences between means of the cases and controls, we used a nonparametric test, the Mann-Whitney test as our data was not following a Gaussian distribution. $P < 0.05$ was considered to be statistically significant.

RESULTS

The youngest patient in our study was a 19 years old male, and the oldest a 66 year old male. Maximum number of patients were in the age group of 31-40 years. Males predominated in our study (67%) as compared to females (33%). Onset of psoriasis was commonest in the age group 21-30 years; females had a younger age of onset as compared with males. The most common type of psoriasis among our patients was the chronic plaque type followed by the guttate type, with palmoplantar type being the least common.

As far as the serum levels of zinc, copper, albumin, and globulin are concerned, there was a statistically significant difference in the serum levels of cases and controls. The serum levels of zinc and albumin were significantly low and levels of copper and globulin were significantly raised among cases as compared with controls. The serum levels of alkaline phosphatase were comparable in cases and controls [Table 1].

DISCUSSION AND CONCLUSION

Psoriasis is a common chronic inflammatory skin disease characterized by a marked increase in keratinocyte proliferation and abnormal differentiation, prominent alterations in dermal capillary vasculature and the presence of dermal and epidermal mononuclear leukocytes and neutrophils.[5,6]

Table 1: Results

Trace elements	Serum levels±SD (cases)	Serum levels±SD (controls)	*P* value*
Zinc	80.028±22.177	109.179±21.587	0.0001
Copper	167.317±23.508	133.884±18.951	0.0001
Albumin	3.762±0.703	4.103±0.514	<0.001
Globulin	3.296±1.460	2.596±1.407	0.0014
Alkaline phosphatase	100.2±35.28 IU/L	98±25.13 IU/L	0.483

*Mann-Whitney test. SD: Standard deviation

A complex interaction between the innate immunity, adaptive immunity and a skin barrier defect is likely to explain the possible pathogenesis of psoriasis, though the response of the disease to biological response modifiers points primarily towards the role of adaptive immunity in causation.[7] Though exact cause in not known, oxidative stress has been widely implicated in the pathogenesis of psoriasis. It has been suggested that generation of reactive oxygen species (ROS) from neutrophils, keratinocytes, and fibroblasts can contribute to neutrophil activation, which plays an important role in the psoriatic process.[8-10] Superoxide dismutase is an important antioxidant enzyme in the body, which plays an essential role in limiting the harmful effects of ROS, which are reported to have a role in causation of psoriasis. Zinc and copper are an integral part of as many as 40 metalloenzymes, including alkaline phosphatase and superoxide dismutase, and changes in their serum levels may reflect in changes in the activity of these enzymes. Researchers have noted that psoriatic lesions retain a high content of zinc compared with uninvolved skin suggesting an imbalance in zinc distribution between serum and psoriatic lesions. Exfoliation of large quantities of skin can thus decrease the serum levels of zinc.[11] This has been reflected in some studies showing decreased levels of zinc in patients with severe psoriasis.[11,12] However, some studies found no statistically significant difference in the serum zinc levels among psoriatics and the normal population.[13,14]

Moreover, decreased serum albumin can also results in alteration of serum zinc levels in psoriasis patients, though some studies have shown that zinc levels are decreased irrespective of serum albumin levels.[10] Reduced albumin in psoriasis patients has been suggested to be due to lowered rates of albumin synthesis or increased rates of turnover.[15] Later, it was also suggested that the hypoalbuminemia in psoriasis patients may be the result of an increased endogenous catabolism of albumin without significant loss through urine, stools or skin.[16] Some researchers have even suggested an increased uptake of albumin by liver and splenic macrophages.[17]

Copper, another important trace metal is present in the serum in at least two fractions, a transport fraction (5%) loosely bound to albumin and ceruloplasmin (95%) firmly bound to globulin. It is important to note that serum copper largely reflects serum ceruloplasmin and is not a sensitive indicator of copper nutritional status. Serum ceruloplasmin levels are known to increase by 50% or more under certain conditions of physical stress, such as trauma, inflammation, or disease. Because over 90% of serum copper is carried in ceruloplasmin, which is increased in many inflammatory conditions, elevated serum copper as seen in our study may simply be a marker of inflammation. Hinks *et al*. have demonstrated a similar increase in serum ceruloplasmin and copper in psoriasis.[18] Rashmi *et al*. demonstrated statistically insignificant higher values of ceruloplasmin among psoriatics as compared to controls; however, they demonstrated a higher copper/ceruloplasmin ratio in psoriatics as compared with controls, which was statistically significant.[19]

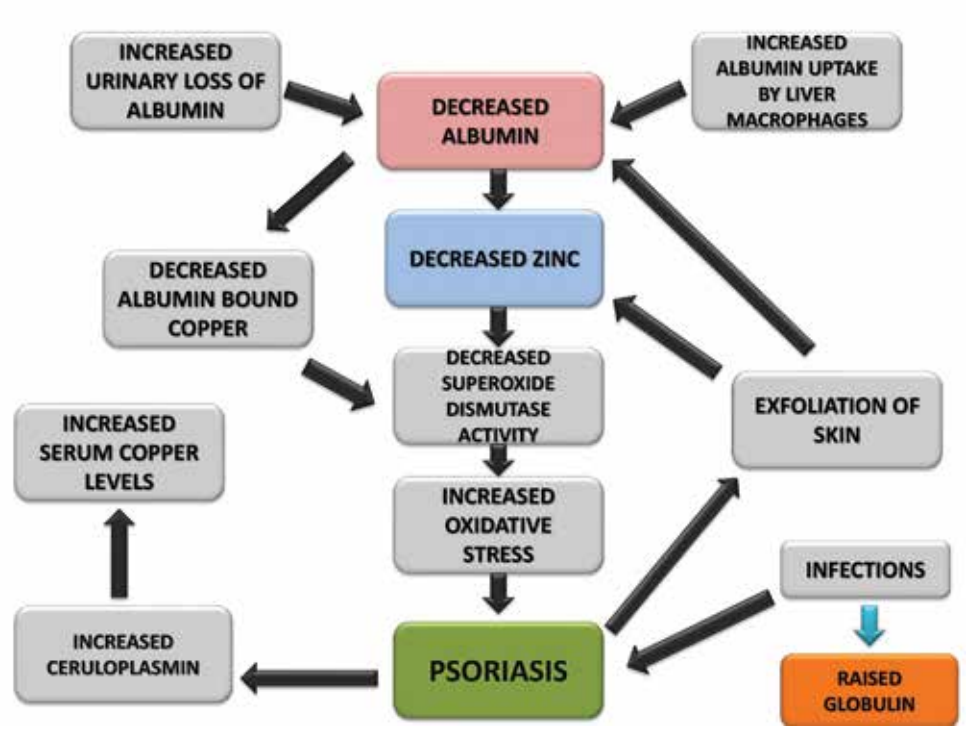

Figure 1: Possible pathogenesis of psoriasis

The results of this study suggest zinc and copper may have a role in etiology of psoriasis as they influence the levels of essential enzyme superoxide dismutase. We therefore propose a possible interplay of factors [Figure 1]. However, whether these levels reflect the abnormalities caused by the disease process or are simply responsible for setting the pathogenesis of psoriasis into motion needs to be investigated further by large-scale studies.

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