EVIDENCE FOR OXIDATIVE STRESS IN OSTEOARTHRITIS

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ABSTRACT

Evidence of increased oxidative stress in patients of osteoarthritis in comparison with healthy control subjects was investigated by measuring the thiobarbituric acid reactive substances (TBARS), vitamin C, reduced glutathione (GSH) and the activities of superoxide dismutase (SOD), catalase and glutathione peroxidase (GPx) in erythrocytes. It was observed that osteoarthritis patients were more susceptible to oxidative damage than controls as evident from increased TBARS and decreased ascorbic acid, GSH, catalase and GPx in erythrocytes. Significant increase in SOD activity found in patients might be an adaptive response. With the understanding of the role of antioxidants in arthritis, it is becoming increasingly clear that these agents seem to be beneficial in osteoarthritis.

KEY WORDS

Oxidative stress, Antioxidant, Osteoarthritis

INTRODUCTION

Osteoarthritis is an inflammatory disorder of the joint. Lipid peroxidation mediated by free radicals is considered to be the major mechanism of cell membrane destruction and cell damage. Free radicals are formed in both physiological and pathological conditions in mammalian tissues (1). The uncontrolled production of free radicals is considered as an important factor in the tissue damage induced by several pathophysiologies (2, 3). Antioxidants are compounds that dispose, scavenge, and suppress the formation of free radicals, or oppose their actions (4).

Since, even modern therapy has provided only limited success in preventing joint destruction, the role of antioxidants as adjunctive therapy seems warranted as they play an effective role in protecting the biological tissues below a critical threshold of reactive oxygen species (5) and constitute a mutually supportive team of defence against reactive oxygen species (ROS).

This study evaluates the association between lipid peroxidation and antioxidants in osteoarthritis patients.

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MATERIALS AND METHODS

Chemicals were purchased from Sisco Research Laboratory, India; Sigma Chemical Co., St. Louis, USA and Merck Ltd., India.

The study was conducted in Department of Biochemistry, Sikkim Manipal Institute of Medical Sciences, Gangtok. Fifteen patients (n=15) with a median age of 50 years (range 30 - 60 years) with the diagnosis of osteoarthritis were selected. The results were compared with those of 15 normal healthy controls of same age group. None of these subjects were chronic smokers or alcoholics and did not suffer from any systemic diseases like hypertension or any diabetic complication. Venous blood was withdrawn without stasis before commencement of any treatment. Heparinised blood sample were used for the preparation of hemolysate and were used for the determination extent of lipid peroxidation by the method of Sinnhuber *et al* (6), reduced Glutathione by the method of Beutler *et al* (7), superoxide dismutase (SOD) (EC 1.15.1.1) by the method of Paoletti *et al* (8), catalase (EC 1.11.1.6) by the method of Beers and Sizer (9), glutathione peroxidase (GPx) (EC 1.11.1.9) by the method of Paglia and Valentine (10) and ascorbic acid by the method of Tietz (11).

Values have been expressed as means $\pm$ SEM. The results were analyzed by using Student's 't' test for unpaired data. P < 0.05 was considered as significant.

RESULTS AND DISCUSSION

There was increased extent of lipid peroxidation in osteoarthritis patients as shown by the significantly

TABLE 1. LEVELS OF TBARS, VITAMIN C AND GSH, AND ACTIVITIES OF SUPEROXIDE DISMUTASE, CATALASE AND GLUTATHIONE PEROXIDASE IN ERYTHROCYTES IN OSTEOARTHRITIS PATIENTS

Parameter	Controls (n=15)	Patients (n=15)
TBARS (nmol/ml)	3.48 ± 0.16	6.35 ± 0.11*
Ascorbic acid (mg/dl)	1.28 ± 0.10	0.76 ± 0.04*
GSH content (µg/mg protein)	3.57 ± 0.19	2.78 ± 0.07*
Superoxide Dismutase (U/mg Hb)	1.27 ± 0.02	1.71 ± 0.03*
Catalase (nmol/mg protein/min)	0.134 ± 0.004	0.126 ± 0.003*
Glutathione peroxidase (U/g haemoglobin)	53.41 ± 1.32	33.56 ± 1.17*
Data is represented as mean ± SD. * P<0.05 vs. the control group		

increased levels of TBARS. In addition, they showed significant decrease in vitamin C, GSH and in the activities of catalase and glutathione peroxidase. Significant increase in SOD activity found in patients might be an adaptive response.

The results of present study indicate higher oxidative stress in osteoarthritis patients, either due to increased extent of lipid peroxidation or due to decreased levels of antioxidants. It is reported that synovial cavity damage correlates with fluctuating oxygen pressure in the joint, overproduction of free radicals and lack of oxygen-processing enzymes and free radical-scavenging molecules (12). Much of the therapeutic effort in osteoarthritis has rightly concentrated on effort to limit the formation of inflammatory mediators such as prostaglandins and leukotrienes with anti-inflammatory agents. However, where this has proved unsuccessful and the disease is chronic there might be a place for secondary therapy aimed at limiting tissue destruction (13). Impaired antioxidant defense and increased lipid peroxidation suggest that treatment with antioxidants at the initial stages of illness may prevent further oxidative injury and deterioration of associated musculoskeletal deficits in osteoarthritis.

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