ASSESSMENT OF OXIDATIVE STRESS AND EFFECT OF ANTIOXIDANT SUPPLEMENTATION DURING RADIOTHERAPY IN CARCINOMA OF UPPER DIGESTIVE TRACT


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ABSTRACT

Oxidative stress was studied by estimating plasma levels of malondialdehyde (MDA), beta carotene, vitamin E and erythrocytic superoxide dismutase (E-SOD) activity in 50 cases of carcinoma of upper digestive tract which included carcinoma of oral cavity, pharynx and oesophagus. While plasma MDA level was found to be increased (3.5 ± 1.0 nmole/ml), a significant decrease in beta carotene (81.2 ± 14.5 mg%), vitamin E (8.5 ± 1.1 mg/L) level and E-SOD activity (657.0 ± 80.6 U/G Hb) were observed in carcinoma of upper digestive tract. Patients were treated with radiotherapy which itself was toxic enough and produced its deleterious effects by generation of reactive oxygen species (ROS). As antioxidants can detoxify ROS, beneficial effect if any, of antioxidant administration during radiotherapy was studied in two groups of patients, group A (n=5, supplemented with antioxidants) and group B (n=5, without antioxidant supplementation). Plasma MDA level was found to be elevated in both the groups but the increase in group B was significant, compared to pretreatment level. Further, body weight was found to be significantly decreased in group B patients, which was maintained in group A patients. Moreover, group A patients showed significant elevation in beta carotene concentration, thus showing beneficial effect of administration of antioxidants during radiotherapy without disturbing the desirable therapeutic effect of radiotherapy.

KEY WORDS : Antioxidant, Carcinoma, Radiotherapy, ROS.

INTRODUCTION

Reactive oxygen species (ROS) or prooxidants, generated in vivo are known to be consumed by cellular and extracellular antioxidants to maintain homeostasis. An imbalance in this equilibrium in favour of prooxidants leads to oxidative stress which contributes to many disease processes including cancer (1). In the present study, ROS related changes were assessed in cancer of upper digestive tract which included oral cavity, pharynx and oesophagus by determining plasma MDA, a lipid peroxidation product, beta carotene and vitamin E, the nutrient antioxidants and E-SOD activity reflecting enzymatic antioxidant status of the body. Radiotherapy, an accepted treatment modality of carcinoma is known to produce its deleterious effects by generation of ROS (2). Antioxidants, especially beta carotene was found to act against the undesirable effects of radiotherapy. Radioprotective role of beta carotene against genotoxic damage was observed (3). SOD was found to protect radiation induced cystitis in bladder carcinoma (4). In this study, patients with carcinoma of oral cavity were followed up to assess the effect of antioxidant supplementation during cobalt 60 radiotherapy both clinically and biochemically.
MATERIALS AND METHODS

A total of 50 histopathologically proved cases of carcinoma of upper digestive tract (oral cavity & pharynx, n=29, oesophagus, n=21) alongwith equal number of age and sex matched healthy controls chosen randomly were included in the study. About 5ml of blood was collected in EDTA vial. Plasma was separated and used to estimate MDA(5), beta carotene and vitamin E (6). Washed RBC was used to estimate SOD activity(7). It was possible to follow up 10 of the patients suffering from carcinoma of oral cavity. All of them were treated with external telecobalt (Co 60) therapy. The total dose given was 6,600 CGy in 33 fractions, each fraction containing 200 CGy.

Five of the patients undergoing radiotherapy were given additional antioxidant supplementation by administering “antoxid” tablets containing beta carotene 50mg, vitamin A palmitate 2500 IU, vitamin E acetate, 10 IU alongwith vitamin C, zinc, manganese and copper, being manufactured by American Remedies Soft Caps Pvt. Ltd, (the dose being 1 tablet thrice daily for 33 days) and were grouped as group A. The other group (group B, n=5) received same schedule of radiotherapy but no antioxidant supplementation was advised.

**Table 1. The levels of different biochemical parameters in cases with carcinoma of upper digestive tract and controls.**

<table>
<thead>
<tr>
<th>Variates</th>
<th>Control n=50</th>
<th>Carcinoma of upper digestive tract n=50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malondialdehyde (n mole/ml)</td>
<td>2.4 ± 0.5</td>
<td>3.5 ± 1.0 *</td>
</tr>
<tr>
<td>Beta carotene (mg %)</td>
<td>99.0 ± 7.2</td>
<td>81.2 ± 14.5 *</td>
</tr>
<tr>
<td>Vitamin E (mg/L)</td>
<td>10.1 ± 1.1</td>
<td>8.5 ± 1.1 *</td>
</tr>
<tr>
<td>Erythrocytic superoxide dismutase activity (U/G Hb)</td>
<td>763.4 ± 38.1</td>
<td>657 ± 80.6 *</td>
</tr>
</tbody>
</table>

All values are expressed as mean ± SD
* Difference statistically significant when compared with the control group (p<0.001)

RESULTS AND DISCUSSION

The study group with carcinoma of upper digestive tract was found to be associated with significantly elevated level of plasma MDA (P < 0.001) and significantly decreased level of plasma beta carotene, vitamin E and E-SOD activity, (p< 0.001) (Table 1).

No significant difference in radiotherapy induced toxicity regarding anaemia, leukopenia, nausea, vomiting and oral mucositis was observed by administration of antioxidants to group A during radiotherapy. It was observed that both the groups