

# Oxidative stress and antioxidant status in pre-eclampsia and eclampsia: an application to forensic significance

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## Abstract

Pre- eclampsia and eclampsia remain the major cause of both maternal and foetal morbidity and mortality; Deficiency of superoxide dismutase, Vitamin E can cause accumulation of free radicals. Therefore, in this study we have measured Nitric oxide, superoxide dismutase (SOD) Plasma thiol and vitamin 'E' in normal pregnant woman and pregnancy with Pre-eclampsia and eclampsia. In Pre-eclampsia and eclampsia significant increase in Nitric oxide level was observed ( $P < 0.05$ ) as compared to the normal pregnant woman. A Significant decrease of super oxide dismutase plasma thiol and vitamin E was observed ( $P < - 0.001$ ) as compared to normal pregnant woman.

Therefore, an increased Nitric oxide and decreased antioxidants may be involved in the pathogenesis of pre- eclampsia and eclampsia.

**Key words:** Oxidative Stress, Nitric oxide, Antioxidant

## Introduction

Pre- eclampsia and eclampsia remain serious complications of pregnancy that affect both mother and child.1 Impairment of vascular endothelial cell function, causing vasospasm, may play role in the pathophysiology of pre-eclampsia and eclampsia.2 Impairment of cell function could be caused by oxidative stress. The unsaturated fatty acids and thiol containing Proteins in cell membrane are susceptible to free radical attack.3 Nitric oxide is free radical and is highly active molecule which reaches the cellular level. Recently nitric oxide (NO) has become of clinical interest because of its relaxant effect on smooth muscle of myometrium.4

Plasma thiol, superoxide dismutase, vitamin E scavenges free radicals and help in protection

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on the endothelial membrane in pregnancy induced hypertension. The present study was undertaken to assess oxidative stress and antioxidant status in pre-eclampsia and eclampsia.

## Material and method

Total 40 patients (pre-eclampsia-20, eclampsia-20) were selected clinical proved cases of pre-eclampsia and eclampsia along with age matched healthy normotensive pregnant women were included in this study, Nitric Oxide (NO) was estimated by method of Cortas and Wakid 1990.5 Plasma thiol levels were measured with the thiol disulphide interchange reaction between 5-51 dithio- bis (2 nitrobenzoic acid) and biological thiol.6 Erythrocyte superoxide dismutase activity was determined by Randox Kit method.7 Vitamin E was assayed by Baker and Frank method. The results were, expressed as mean + or - SD and statistically evaluated by the student 't' test.

## Result

The study group with pre- eclampsia and

eclampsia was found to be associated with significantly elevated levels of nitric oxide ( $P < 0.05$ ) as compared with normotensive pregnant woman and significantly reduced level of RBC superoxide dismutase activity ( $P < 0.001$ ). The plasma thiol and vitamin E are as compared with control group (Table -1).

### Discussion

Biological system can produce free radical and other potent oxidants in vivo are known to be consumed by cellular, extracellular antioxidant to maintain homeostasis. An imbalance in system in favour of pro-oxidant leads to oxidative stress which contributes to many diseases. Serum nitric oxide showed significant increase ( $P < 0.05$ ) in pre-eclampsia and eclampsia when compared with normotensive pregnant women.<sup>8</sup> These findings may be because of the fact that serum concentration of nitric oxide has been used in vivo and in vitro as an index of 'NO' generation.<sup>9</sup> Significantly increased nitric oxide in pregnancy induced hypertension with proteinuria may be due to mediators such as rennin-angiotensin-aldosterone system. Endothelins and prostaglandins might cause vasospasm, which is basic pathophysiology of hypertension and activated Nitric Oxide Synthetase (NOS) in the vascular epithelium in response to stress might compensationally enhance the nitric oxide production. Hypertension superoxide anion can inactivate the endothelium derived relaxing factor and may inhibit prostacyclin synthesis. Consequent smooth muscle contraction, vasospasm and platelet aggregation are all marked features of pregnancy induced hypertension.

The work of Stephon Wisdom 1991<sup>10</sup> has demonstrated that superoxide activity was reduced in gestational period of normal pregnancy and was lowest in pregnancy induced hypertension with proteinuria. This could reflect reduced enzyme production or enzyme inactivation. Similar findings are observed in our study. Reduction of RBC superoxide dismutase activity in pregnancy can not be ruled out, but there could be result of intermolecular or intramolecular cross links of proteins. Impaired enzymatic defense leads to accumulation of reactive oxygen species of  $O_2$

such as  $H_2O_2$  which induces lipid peroxidation and leads to abnormal pregnancy.

The plasma thiol levels were found to be significantly decreased in pre-eclampsia and eclampsia as compared to normotensive pregnant women; such changes are compatible with oxidative stress.<sup>11</sup> The decrease in plasma thiol concentration was greater than what would be expected simply from the normal hemodilutional changes of pregnancy.

It was suggested by Wong et al 1991 that the decreased levels of vitamin E in pre-eclampsia are attributable to elevated levels of free radicals signifying its role as an antioxidant. Another possibility is that there is decreased absorption of vitamin E from the gut as a result of vasoconstriction with pre-eclampsia.

The chain breaking role of vitamin E can be attributed to its ability in quenching the highly reactive lipid peroxy intermediate by donating hydrogen and converting it into the semistable lipid peroxide. This prevents the abstraction of hydrogen from the adjacent PUFA by the lipid peroxy radical and thus hampers the generation of the lipid carbon radical.

In conclusion, a significant elevation in nitric oxide levels was found in pre-eclampsia and eclampsia in pregnancies which contribute to pathophysiology and pathogenesis of pre-eclampsia and eclampsia. Some antioxidant systems such as superoxide dismutase (SOD), Vitamin E have been demonstrated to be reduced in red blood cells in pre-eclampsia.<sup>12</sup> Hence the present study suggests that the supplement of antioxidants or free radical scavengers may benefit pregnant women at risk of developing pre-eclampsia and eclampsia.

### Medicolegal Applicability

In consumer courts most of the cases are related to pregnancy. As pregnancy has emotional attachment with family members, they are very curious about the treatment. So during antenatal period if antioxidants are supplemented, it will help to reduce pre-eclampsia and eclampsia mortality. This preventive measure ultimately reduces the consumer court cases against Gynecologist. It will also reduce anxiety of Gynecologist.

**Table 1: The levels of Biochemical parameters in patients with Pre- eclampsia, eclampsia and controls**

Biochemical Parameters	No	Nitric oxide $\mu\text{mol}/\text{lit}$	SOD units/ml	Thiol units/lit	Vit E mg/dl
Control group (normal pregnant women)	20	30.93 $\pm$ 1.39	2.80 $\pm$ 0.57	294 $\pm$ 87	0.66 $\pm$ 0.11
Pre- eclampsia	20	42.30 $\pm$ 2.0	1.02 $\pm$ 0.25	248 $\pm$ 81	0.53 $\pm$ 0.14
Eclampsia	20	45.36 $\pm$ 2.59	0.89 $\pm$ 0.30	238 $\pm$ 82	0.36 $\pm$ 0.18

N- Indicates no. of cases studied, Values are expressed as mean  $\pm$  SD.

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