Study of Oxidative Stress in Pregnancy and Its Association with Pregnancy Induced Hypertension

Razia Sultana[1], Kamal Raj Singh[2], Vrunda Joshi[3]

ABSTRACT

Introduction: Pregnancy induced hypertension (PIH) is one of the leading cause of maternal and fetal morbidity and mortality. Oxidative stress is considered as one of the aetiological factor in PIH. The present study was done to study the levels of plasma malondialdehyde (MDA) and serum superoxide dismutase (SOD) level in pregnancy and their association with PIH.

Material and methods: Study was conducted in the Deptt of Obstetrics and Gynecology of G R Medical College, Gwalior, MP. 100 antenatal patients were included in the study and they were divided into two groups: normotensive group (50 patients) and pregnancy induced hypertension group (PIH) (50 patients). MDA was estimated as per Jean et al method and SOD by Mishra and Fridovich in all the patients.

Results: Mean MDA level in normotensive, mild PIH and severe PIH patients was 4.15±0.35 nmol/ml, 5.11±0.41 nmol/ml and 6.27±0.37 nmol/ml respectively. Mean SOD level in normotensive, mild PIH and severe PIH patients was 3.15±0.21 unit/mg/ml, 2.56±0.32 unit/mg/ml and 2.02±0.19 unit/mg/ml respectively. There was statistically significant difference in the value of MDA and SOD between both the groups ($p<0.05$).

Conclusion: In women with preeclampsia, there is a significant elevation of plasma MDA level and reduction of serum SOD level which suggests significant oxidative stress in pregnancy leading to endothelial dysfunction, which may be responsible for PIH.

Keywords: Pregnancy induced hypertension, malondialdehyde, superoxide dismutase

INTRODUCTION

Preeclampsia might be the result of inadequate maternal care and this may advance to eclampsia if proper care is not taken, resulting in various maternal complications. Endothelial dysfunction is considered as one of the etiological factor for the development of preeclampsia.[1]

Lipid peroxidation is considered as an important marker for endothelial dysfunction. Reports have shown that free radicals generated due to oxidation process may enhance vascular dysfunctions.[2]

Large number of evidences has shown that in women with preeclampsia, there is an increased lipid peroxidation along with reduction in natural antioxidant protection resulting in oxidative stress.[3]

Level of lipid peroxidation in body can be best estimated by plasma MDA level. High level of MDA indicates that body is in stressed state. SOD exhibit free radical scavenging mechanisms, resulting in reduction of oxidative stress. A lower level of SOD indicates an increased oxidative damage to the body.[4]

Keeping in mind the above discussions, present study was done to evaluate the serum SOD and plasma MDA levels in antenatal patients and to find their association with PIH.

MATERIAL AND METHODS

The present study included 100 patients who have been admitted in the Department of Obstetrics and Gynaecology, Kamla Raja Hospital, GR Medical College, Gwalior.

A written informed consent from all the patients and Ethical Committee approval was obtained before starting the study.

Patients were divided into Normotensive group (50 patients) and Pregnancy induced hypertension group (PIH) (50 patients).

Antenatal patients in third trimester (28-40 weeks of gestation) were included in the study. PIH was classified as mild (systolic blood pressure >140 mmHg, diastolic blood pressure >90 mmHg and urinary albumin traces or +1) and severe (systolic blood pressure >160 mmHg, diastolic blood pressure >110 mmHg and urinary albumin +2). Above alteration in blood pressure was observed at least on two different occasions at least 6 hours apart.

A detailed history, general physical examination and obstetric examination were performed.

Estimation of plasma malondialdehyde was done as per method of Jean et al (1983) and serum superoxide dismutase was done by the method given by Mishra and Fridovich (1972) in the Department of biochemistry for a period of one year.

STATISTICAL ANALYSIS

All the data was analyzed using IBM SPSS- ver.20 software. Analysis was performed using chi-square test and independent sample student t test. P values <0.05 were considered to be significant.

RESULTS

In present study, there were equal no. of normotensive (50%) and PIH patients (50%). Out of 50 patients who had PIH, 30 (60%) had mild preeclampsia and 20 (40%) had severe preeclampsia.

Distribution of patients according to age showed that most of the patients in normotensive group belong to 21-25 years

[1]Ex-Resident, [3]Professor, Department of Obtets. and Gynecology, [2]Resident, Department of Anesthesia, G.R. Medical College, Gwalior (M.P.), India

Corresponding author: Dr Razia Sultana, c/o Mohammad Anwer Khan, Shivagi Nagar, Po. R.K. Puri Thatipur Gwalior, Pin code-474011, India

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Investigation		Normotensive N=50	Mild PIH N=30	Severe PIH N=20
MDA (nmol/ml)	2-4	23 (46)	0 (0)	0 (0)
	4-5	27 (54)	13 (43.33)	0 (0)
	5-6	0 (0)	16 (53.33)	7 (35)
	>6	0 (0)	1 (3.33)	13 (65)
SOD (units/ mg/ml)	3-3.6	41 (82)	2 (6.66)	0 (0)
	2.5-3	8 (16)	20 (66.66)	1(5)
	2-2.5	1 (2)	8 (26.66)	12 (60)
	1.5-2	0 (0)	0 (0)	7 (35)

Data is expressed as no of patients (%), P value for mean MDA; between normotensive and mild PIH (t=11.13, df=78, p<0.01), normotensive vs severe PIH (t=22.53, df=68, p<0.01), mild PIH vs severe PIH (t=10.18, df=48, P<0.01), P value for Mean SOD; normotensive vs mild PIH (t=9.96, df=78, p<0.01), normotensive vs severe PIH (t=20.87,df=68, p<0.01), mild PIH vs severe PIH (t=7.05, df=68, P<0.01). MDA; malondialdehyde, SOD; serum superoxide dismutase, PIH; pregnancy induced hypertension.

Table-1: Levels of plasma MDA and SOD in antenatal patients

of age [30 (60%)] followed by 10 (20%) patients who were from 26-30 years of age. Out of 50 PIH patients, [24 (48%)] were from 21-25 years age group followed by 14 (28%) patients who belonged to age range of 26-30 years (P>0.05).

In present study, 20 (40%) normotensive patients were primigravida while 15 (50%) patients who had mild preeclampsia and 16 (80%) patients with severe eclampsia were primigravida. Therefore study showed that PIH was more common in primigravidas especially sever PIH (X^2, df=1, p=0.02).

Both normotensive and PIH group were comparable as per the educational status of patients. Most of the patients in normotensive group were illiterate [17 (34%)], 13 (26%) were up to intermediate, 14 (28%) were graduate whereas in patients with PIH, 19 (38%) were illiterate, 11 (22%) patients and 11 (22%) were intermediate and graduates respectively (X2=0.17, df=1, p>0.05).

In normotensive group most of the patients belonged to gestational age of 33-36 weeks [24 (48%)] followed by 18 (36%) patients who belong to gestational age of 28-32 weeks (X2=0.04, df=1, P>0.05).

Patients in both normotensive and PIH group were comparable with respect to gestational age. All the patients who were enrolled were in their third trimester (X2=004, df=1, p>0.05).

Most of the patients in nomotensive [30 (60%)] and PIH group [31 (62%)] belong to class-III as per the modified P Kumar's classification for socioeconomic status.

In normotensive group, 48 (96%) patients had DBP between 70-80 mmHg, 16 (53.33%) patients of mild PIH patients had DBP of >90 mmHg and 14 (70%) patients of severe PIH group had blood pressure of >110 mmHg as per the criteria used for defining the patients as normotensive, mild PIH and severe PIH.

In present study, 45 (90%) normotensive patients had their urine albumin as nil whereas majority of study group patients had their urine albumin either +1 or +2.

Mean MDA level in normotensive, mild PIH and severe PIH patients was 4.15±0.35 nmol/ml, 5.11±0.41 nmol/ml and 6.27±0.37 nmol/ml respectively. Mean SOD level in normotensive, mild PIH and severe PIH patients was 3.15±0.21 unit/mg/ml, 2.56±0.32 unit/mg/ml and 2.02±0.19 unit/mg/ml respectively.

DISCUSSION

Oxidative stress generates free radicals which are transient and unstable. Generation of free radical leads to lipid peroxidation which in turn results in increase in MDA level, which is a marker of lipid peroxidation.[3] SOD is a biological antioxidant enzyme, which has an important role in preventing oxidative stress.[5]

In present study MDA was significantly increased in preeclamptic women as compared to normotensive women. Studies have reported that plasma MDA level is increased with the advancement of normal pregnancy.

Sayyed et al performed a similar study on 80 patients to evaluate lipid peroxidation and antioxidant status in pregnant women. They reported that plasma MDA level (8.30 ± 0.97 nmol/ml) was significantly increased in women with preeclampsia (p<0.05) as compared to normotensive (5.60±0.79 nmol/ml) women whereas serum SOD level (3.03 ± 0.63 U/ml) was decreased as compared to normal women (5.19 ± 0.93 U/ml) (P<0.01).[3]

End product of lipid peroxidation can produce malfunction in vascular endothelium of mother, also free radicals can suppress prostacyclin synthesis and may induce contraction of smooth muscle. Both these process may lead to vasospasm which is eminent characteristic of preeclampsia.[1]

Pandey et al did a study on 66 patients of 28-38 weeks of gestation and reported significant decrease in SOD activity in women with preeclampsia (0.347 ± 0.069 unit/mg protein) as compared to normal women (0.704 ± 0.109 unit/mg/ml) (P<0.001).[5] The results of the present study are consistent with the previous studies. The possible reason for reduction in SOD activity in women with preeclampsia may be due to enhanced activity of free radicals resulting in decreased SOD production.[6]

A study done on 70 women by Zhou et al, also reported a significant increase in plasma MDA level 33.42± 4.50 nmol/g and decrease in serum SOD (1866±214 U/g·Hb) in women with preeclampsia as compared to normal women (MDA; 28.27±4.44 nmol/g·Hb, SOD; 2055±201 U/g·Hb).[7]

Lekharu et al enrolled 75 normal pregnant women and found that that MDA level was significantly high in pregnant women and SOD level was lowest in third trimester.[8]

CONCLUSION

The present study had showed that oxidative stress as suggested by the alterations in levels of MDA and SOD may be the contributing factor in the pathogenesis of pregnancy induced hypertension. However the sample size in present study was small low; a large randomized trial is required to confirm the results

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