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Evaluation of total antioxidant capacity before & after administration of iron therapy in iron deficient pregnant women

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Abstract
Background: *Pregnancy is characterized by dynamic changes in multiple body systems resulting in increased basal oxygen consumption and in changes in energy substrate use by different organs including the fetoplacental unit. The aim of the present study was to assess the markers of oxidative stress and antioxidative enzymes in pregnant anaemic women.*
Material & Methods: *The present study is being conducted on pregnant women with anemia of mild, moderate and severe degree admitted or outdoor patient in SMS Medical College & Hospital, Jaipur (Obstetrics and Gynecology Dept.) Total 50 cases are taken out of them some receive oral iron or parental iron therapy. 50 controls are also taken. History is taken in full details regarding age socio economic status, diet, presenting complaints, and obstetric history.*
Results: *In our study the incidence of anemia is more in 21-25 year that is 54%. The incidence of such cases who has not taken any form of iron during their antenatal period is 60%. There is significant rise in Hb level before therapy and after therapy (p value <0.0001) and average Hb level of cases who have taken oral iron and i/v iron is 9.91 and 9.93. The comparison of TAC between anemia patients (cases) having oral iron v/s i/v iron is not significant (p=0.35).*
Conclusion: *One should be vigilant while dealing with severe anaemia in puerperal period. Early diagnosis and treatment of maternal anaemia in the antenatal follow up is critical to minimize perinatal complication.*
Keywords: *Iron therapy, Antioxidant, Pregnancy, Hb level.*

Introduction

Prevalence of anaemia in pregnancy shows great variations in different parts of the world. Studies

from industrialized countries show that 2.0% - 45.0% of pregnant women are having anaemia which is generally higher in developing countries (5.0% -90.0%). According to WHO report, the global prevalence of anaemia among pregnant women is 55.9%. In India, this prevalence has been reported to be in the range of 33.0%-89.0%.[1] Anaemia is defined as reduction in circulating red cell mass and corresponding decrease in haemoglobin mass and oxygen carrying capacity of blood.

Pregnancy is a condition exhibiting increased susceptibility to oxidative stress, defined here as a disturbance in the oxidant-antioxidant balance in favour of the former, leading to potential damage. Pregnancy is characterized by dynamic changes in multiple body systems resulting in increased basal oxygen consumption and in changes in energy substrate use by different organs including the fetoplacental unit. From early pregnancy the human placenta influences maternal homeostasis; it is rich in mitochondria and when fully developed consumes about 1% of the basal metabolic rate of the pregnant woman. It is also highly vascular and is exposed to high maternal oxygen partial pressure. These characteristics explain, in part, the generation of superoxide, because about 5% of all electrons in the mitochondrial respiratory chain leak out of the mitohondria. Generation of reactive oxygen species increases in placenta in pregnancy. Normal cell integrity and functions may be broken via considerable reactivity of ROS. Reactive oxygen species generated by normal metabolism. These species can neutralized by antioxidant system of body, these are enzymatic and nonenzymatic. Enzymatic components are alase, cytochrome peroxidase and glutathione peroxidase. Oxidative stress is increased through increase oxidant levels and/or decrease in antioxidant enzyme capacities in IDA. Generally, decreased GSII-Px activity along with normal or increased SOD and CAT activity are the main finding in IDA.[2]

Free radical generation occurs normally which has high affinity for lipids, DNA, and proteins Lipid peroxidation is an oxidative process which occurs at low levels in all cells and tissues. Under normal conditions a variety of antioxidant mechanisms serve to control this oxidative process. The generation of free radicals is a normal physiological process but increased production of free radicals can act on lipids to causes lipid peroxidation. The cells have evolved a number of counter acting antioxidant defences. Free radical scavenging mechanisms includes enzymatic and non-enzymatic antioxidants which limit the cellular concentration of free radical and prevent excessive oxidative stress.[3]

As we know iron is essential component of antioxidant system, by supplementation of oral and parenteral iron we can improve the antioxidant capacity in iron deficient pregnant women. The aim of the present study was to assess the markers of oxidative stress and antioxidative enzymes in pregnant anaemic women. The studies of experimental and human evidences support clear roles for increased oxidative stress due to susceptibility of lipids of red cell membrane to peroxidation. A low serum iron alone does not diagnose iron deficiency, a combination of serum iron, total iron binding capacity (TIBC) along with haemoglobin (Hb) are conjunctively essential to diagnose. The normal alt erythrocytes can resist oxidative stress by several antioxidant fence systems.[4] Imbalance between oxidative stress (OS) and tioxidant system is present in iron deficient patients.

In light of the several epidemiological, clinical and laboratory investigations supporting the role of OS in anaemia, we aimed to study alterations in the levels of oxidants and antioxidants in patients of iron deficiency anaemia (IDA) and comparison of improvement in oxidative stress between oral vs. parenteral iron therapy.

Material & Methods

The present study is being conducted on pregnant women with anemia of mild, moderate and severe degree admitted or outdoor patient in SMS Medical College & Hospital, Jaipur (Obstetrics

and Gynaecology Dept.) Total 50 cases are taken out of them some receive oral iron or parental iron therapy. 50 controls are also taken.

Methods

History is taken in full details regarding age socio economic status, diet, presenting complaints, and obstetric history. Symptom regarding anemia like palpitation weakness fatigue is asked. Information is also obtained regarding worm infestation, bleeding disorder, past menstrual cycle, and hemorrhoids.

Haemoglobin estimation by cyanmethemoglobin method

Test Principle

The cynamethemoglobin method standard complies to the specification and defined by ICSH (International Committee for Standardization in Hematology) which is based on the molecular weight of hemoglobin (64,458) Dalten and a milimolar extinction coefficient of 44. Cyanomethemoglobin standard is used for direct comparison with blood. Drabin's solution on mixing with whole blood converts hemoglobin to cyanomethemoglobin. The absorbance of cyanmethemoglobin is proportional to the hemoglobin concentration.

Total Antioxidant Capacity (TAC) Estimation

The TAC was done spectrophotometry in serum of anemic pregnant women (cases) as well as healthy control pregnant women. ABTS(R) (2.2 azino di 13-ethyl benzthiazoline sulphonate} is incubated with peroxidase (methemoglobin) and H202 to produce radical cation ABTS(R) . This has a relatively stable blue green colour which is measure at 600nm. Antioxidant in added sample cases suppression of this colour production to a degree which is proportion to their concentration.

Results

In our study the incidence of anemia is more in 21-25 year that is 54% (table 1). The incidence of such cases who has not taken any form of iron during their antenatal period is 60% (table 2).

In our study the incidence of cases who have taken oral iron treatment and IV iron is 34% and

66% respectively (table 3). The average Hb level of cases before therapy and after therapy is 7.3 and 9.9 respectively. There is significant rise in Hb level before therapy and after therapy (p value <0.0001) (table 4) and average Hb level of cases who have taken oral iron and i/v iron is 9.91 and 9.93. There is no significant difference (p=0.9) (table 5).

In our study comparison of TAC between anemic patients (cases) before therapy v/s after therapy is (p<0.0001) (table 6) and comparison of TAC between anemia patients (cases) having oral iron v/s i/v iron is not significant (p=0.35) (table 7).

Table No. 1: Distribution according to age

Age of Patients	No.	%
$\leq$20 year	7	14%
21-25 year	27	54%
26-30 year	14	28%
>30 year	2	4%

Table No. 2: Distribution of cases according to related history

Related History	No.	%
H/o of oral Fe treatment	1	2%
H/o IV iron	5	10%
H/o blood transfusion	10	20%
H/o hookworm disease	2	4%
H/o Haemorrhoids	2	4%
Not taken any treatment	30	60%

Table No. 3: Distribution of cases according to type of treatment

Type of treatment	No.	%
Oral Fe treatment of one month	17	34%
IV 3rd dose of iron	19	38%
IV 5th dose of iron	14	28%

Table No. 4: Comparison of Hb level between anemic patients (cases) before therapy v/s after therapy

Parameter	Before therapy (n=50)	After therapy (n=50)
Hb level (gm/dl) mean range	7.3	9.932
S.D.$\pm$	0.93	0.55
p value significance level	Significant	p<0.0001

Table No. 5: Comparison of Hb level between anemic patients (cases) oral iron v/s i/v iron

Parameter	Oral iron 17 (n=50)	IV Oral iron 33 (n=50)

Hb level (gm/dl) mean range	9.91	9.93
S.D.±	0.51	0.58
p value significance level	Not significant	p=0.9

Table No. 6: Comparison of TAC between anemic patients (cases) before therapy v/s after therapy

Parameter	Before Therapy (n=50)	After Therapy (n=50)
TAC (mM)	0.17	0.45
S.D ±	0.041	0.071
p value significance level	Significant	p<0.0001

Table No. 7: Comparison of TAC between anemia patients (cases) having oral iron v/s i/v iron

Parameter	Oral iron 17 (n=50)	IV iron 33 (n=50)
TAC (mM)	0.44	0.46
S.D ±	0.07	0.71
p value significance level	Not Significant	p=0.35

Discussion

Anaemia is the most common cause of maternal mortality and morbidity in a developing country like India. Bartley ME reported 2.2% seriously anaemic pregnant women in Andhra Pradesh. Trinh LT has reported 4% severe anaemic in Vietnam.[5]

In pregnant females the incidence of anaemia was highest in developing countries. Several factors influence the incidence and severity of anaemia like extent of prenatal and intranatal care, socioeconomic status, parity and type of anaemia. But our institute being a tertiary institute located in central India caters to a relatively high risk group of women and large number of referrals. So accordingly, the prevalence of severely anaemic pregnant women is high.

Most severe anaemia cases were in the age group of 20-25 years (129 out of 200 cases i.e. 64.5%). This study is in accordance with Monika Maihotra and Sharma et al. study in Delhi (2002)[6] where maximum cases were of mean age (27±4.25 years). In developing countries, as women become multiparous in younger age group, hence anaemia is also prevalent in same age group. Young multiparity is an important cause of anaemia. As such adolescent education is very important.

In our study we give oral iron treatment to 34% of cases and i/v iron to 66%. Hb level and TAC improved after treatment. Isler M et al[7] have studied that enzymatic antioxidant such as CAT, SOD, GPx were increase significantly after giving iron in IDA patients.

According to Erdal Kurtoglu[8], the activity of SOD, CAT in 63 patients of iron deficiency anemia before and after 6 weeks of iron supplementation and at the time when body iron stores are saturated. After 6 weeks of iron supplementation a significant increase of oxidative was observed in the treated subjects.

Conclusion:

One should be vigilant while dealing with severe anaemia in puerperal period. Watch for postpartum hemorrhage and heart failure. Hb and TAC relationship is directly proportional, means with the increase in Hb, TAC levels are also improved, which leads to improved anaemia related pregnancy complications. Early diagnosis and treatment of maternal anaemia in the antenatal follow up is critical to minimize perinatal complication.

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