Evaluation of Serum Level of Serum Catalase and SOD as a Predictive Factors in Preterm Labor Patients

Sura Zeki Salih[1], Mutaz S. Ahmied[2], Israa H. Abdulkareem[2]

[1]M.Sc. Student, [2]Assist Prof., College of medicine, Tikrit University, Tikrit, Iraq

Abstract

The study is a comparative case control study conducted on 45 preterm delivery between (28-37 week) of gestation as cases group and 45 term delivery between (37-42 week) of gestation as control group, at obstetrical and gynecology department of Salah Alden general hospital in Salah Alden city from 20th of November 2019 to 15th February 2020. The blood sample taken from participated women and the oxidative stress parameter (F2-8-isoprostan and protein carbonyl) was measured by ELISA technique. The cases were Single and twin pregnancy with cervical dilatation >3 cm and fully effaced cervix, and/or rupture membrane, Uterine contraction 3per 10 min and Indicated labor pregnancy like bleeding, DM, hypertension, pPROM, fetal destress, fetal death. But uncertain gestational age, elective term cesarean section, liver disease, renal disease and hepatitis infected women were excluded.

Result: Mean age of participants was (26.05±6.59 years) with a range of (14-45years) and mean weight was (74.84±6.728 Kg), range of (60-95 Kg) and mean height of participated (156.14±5.3 cm) and range of (150-170 cm).Superoxide dismutase and catalase showed significant decrease in preterm labor (mean±stander error) (529.161 ± 35.87 U/ml) (1.637 ± 0.12 pg/ml) respectively in compare with (mean± stander error) (1.637± 0.12U/ml) (529.161± 35.87 pg/ml) in preterm labor.

Conclusion: This study showed that catalase and superoxide dismutase significantly decrease in preterm labor group.

Keywords: *Serum catalase; SOD; Predictive Factors; Preterm Labor Patients.*

Introduction

A preterm birth (PTB) defined as a labor occurring before 37 weeks (259 days) of gestation. PTB are usually classified into three categories: medically induced (25% of all PTB), spontaneous preterm labor (50% of all PTB) and preterm premature rupture of membranes (pPROM) (25% of all PTB). Preterm birth are divided into four degrees of prematurity: extremely preterm (less than 28 weeks), very preterm (28 – 31^{+6} weeks), mild preterm (32 – 33^{+6} weeks) and moderate preterm (34 – 36^{+6} weeks)[(1)]. Preterm birth, depending on one's point of view, may be considered as an adverse gestational outcome (where a fetus is incapable to achieve its in utero growth potential) or a favored outcome (e.g., where an abortion or non-viable prematurity has been successfully prevented). Even healthy women with low-risk pregnancies, a fraction of babies can be probably born preterm[(2)].

The most popular definition of free radicals is {molecules or molecular fragments that contain one or more unpaired electrons in the atomic or molecular orbitals}. The free radicals are uncharged, short-lived molecules and very reactive. Human body contain about 10,000–20,000 free radicals which attack each individual cell of human body. Numerous of these radicals are beneficial in that they effort for immune cells responsible

Corresponding Author:
Sura Zeki Salih
M.Sc. Student, College of medicine, Tikrit University, Tikrit, Iraq
e-mail: drnihadkhalawe@gmail.com

for bacterial cells killing and toning the smooth muscles, which in order regulate the normal function of blood vessels and the internal organs. Uncontrolled generation of the free radicals in human body may cause various harmful effects like heart and neurodegenerative diseases, autoimmune diseases, cancers, etc.[3].

Preterm labor is a complex condition resulting from multiple etiologic factors, but it is well documented and accepted that both inflammation and infection represent highly significant risk factors for PTB. However, despite the public health and clinical significance of PTB and recent research achievements, the relations between infectious agents, immunological or molecular pathways and triggering factors for spontaneous PTB remain poorly understood reflecting the complexity of this obstetrical problem. It has been widely acknowledged that OS may involve in the pathogenesis of human disease and represent a major topic in all areas of medicine [4]. In this regard, there is emerging evidence that an imbalance between oxidants and antioxidants may play a role in PTB [5].

This study is designed to evaluate the association of catalase and SOD with preterm labor.

Patient and Method

This study is case control study carried out in Salah Alden city from 20th of November 2019 to 15 February 2020. The study included 90 pregnant women attend Salah Alden general hospital department of obstetrics and gynecology for labor, 45 of them are preterm (between 28 and 37 weeks) as cases and 45 of them complete term (between 37 and 41 weeks) as control, the patients included Single and twin pregnancy, cervical dilatation >3 cm, fully effaced cervix, and/or rupture membrane, uterine contraction 3per 10 min and indicated labor like bleeding, DM, hypertension, pPROM, fetal destress and fetal death. The exclusion criteria include uncertain gestational age, elective term cesarean section, liver disease, renal disease and hepatitis infected women. Ablood sample was taken from them and an interview was carried out with these patients using questionnaire form designed by the investigator including their demographic characteristics, age, weight, length. etc. The antioxidant parameter (catalase and SOD) was measured by ELISA technique and colorimetric methodrespectively.

Results

The results showed that mean age of participants was (26.05±6.59) years with a range of (14-45) years and mean weight was (74.84±6.728) Kg, range of (60-95)Kg and mean height of participated (156.14±5.3)cm and range of (150-170) cm. The participants include 32 urban females and 58 rural and they deliver 51 male babies and 39 females. 22 of the participants are prim gravitas and the other 77 are multigravida.

The study groups include 15 prim gravida women and 30 multigravida in preterm group and 7 prim gravida and 38 multigravida in term group.

The study groups include 10 women with positive history of abortion and 35 women with negative history in preterm group and 8 women with positive history of abortion and 37 women with negative history in term group.

Catalase Activity: Comparison between study groups regarding serum catalase activity level was performed using anova test. Cases were compared with controls. There was a statistically significant difference in the serum mean catalase activity level for cases group (mean±S.E) (529.161± 35.87) pg/ml and control group (mean±S.E) (739.284± 17.60) pg/ml, p value <0.001. Table (1).

Table (1): Serum catalase activity level comparison between term and preterm groups

Catalase (pg/ml)						
Group	**N**	**Mean**	**S.E**	**Minimum**	**Maximum**	**P value**
Term	45	739.28	17.60	365.13	992.08	*<0.001
Preterm	45	529.16	35.87	27.78	902.08	

*The result was highly significant.

Superoxide dismutase activity: Comparison between study groups regarding serum SOD activity level was performed using anova test. Cases were compared with controls. There was a statistically significant difference in the serum mean SOD activity level for cases group (mean±S.E) (1.637±0.12) U/ml and control group (mean±S.E) (2.251± 0.14) U/ml, p value 0.002. Table (2).

Table (2): Serum SOD activity level comparison between term and preterm labor

Superoxide Dismutase (*U/mL*)						
Group	**N**	**Mean**	**S.E**	**Minimum**	**Maximum**	**P value**
Term	45	2.25	0.14	0.63	3.78	*0.002
Preterm	45	1.637	0.12	0.06	3.57	

*The result was highly significant.

Comparison of serum mean level of SOD between patient complain of contraction (mean±S.E) (1.655±0.23) U/ml and patient not complain of contraction (mean±S.E) (1.603±0.19) U/ml within preterm group show no statistical significant with p value 0.364.

Comparison of serum mean level of SOD between patient complain of pPROM (mean±S.E) (1.515±0.30) U/ml and patient not complain of pPROM (mean±S.E) (1.681±0.27) U/ml within preterm group show no statistically significant with p value 0.174.

Comparison of serum mean level of catalase between patient complain of contraction (mean±S.E) (572.039±67.11) pg/ml and patient not complain of contraction (mean±S.E) (446.705±24.67) pg/ml within preterm group show no statistically significant with p value 0.213.

Comparison of serum mean level of catalase between patient complain of pPROM (mean±S.E) (534.534±98.97) pg/ml and patient not complain of pPROM (mean±S.E) (527.243±87.23) pg/ml within preterm group show no statistically significant with p value 0.947.

The study show that the comparison of serum means level of catalase and SOD between prim and multigravida in preterm group no statistically significant. Table (3)

Table (3): Comparison Oxidative stress level between prime and multi gravida in preterm group

No. of previous pregnancy (in preterm group)		**Catalase (pg/ml)**	**SOD (U/ml)**
Prim gravida	Mean	542.56	1.38
	S.E	69.04	0.28
Multi gravida	Mean	522.19	1.76
	S.E	42.08	0.11
P value		*0.76	*0.16

*The result was non-significant.

The study show that the comparison of serum catalase and SOD mean level between prim and multigravida in term group no statistically significant Table (4).

Table (4): Comparison Oxidative stress level between prime and multi gravida in term group.

No. of previous pregnancy in term group		Catalase (pg/ml)	SOD (U/ml)
Prim gravida	Mean	773.94	2.24
	S.E	47.55	0.36
Multi Gravida	Mean	733.34	2.25
	S.E	19.04	0.15
P value		*0.42	*0.97

*The result was non-significant.

The study show that the comparison of serum means level of catalase and SOD between women with negative history of abortion and women with positive history of abortion in preterm group no statistically significant. Table (5).

Table (5): Comparison Oxidative stress level with history of abortion in preterm group

History of abortion (in preterm group)		Catalase (pg/ml)	SOD (U/ml)
Negative	Mean	532.62	1.58
	S.E	41.42	0.15
Positive	Mean	516.16	1.81
	S.E	67.85	0.12
P value		*0.85	*0.45

*The result was non-significant.

The study show that the comparison of serum means level of catalase and SOD between women with negative history of abortion and women with positive history of abortion in term group no statistically significant. Table (6).

Table (6): Comparison Oxidative stress level with history of abortion in term group

History of abortion (in term group)		Catalase (pg/ml)	SOD (U/ml)
Negative	Mean	739.54	2.15
	S.E	21.32	0.15
Positive	Mean	738.22	2.66
	S.E	16.14	0.24
P value		*0.97	*0.15

*The result was non-significant.

The study show that the comparison of serum mean level of catalase and SOD between women with positive history of preterm labor and women with negative history of preterm labor in preterm group no statistical significant. Table (7).

Discussion

Spontaneous preterm birth (sPTB) is a common major pregnancy complication leading to perinatal morbidity and mortality as well as short- and long-term sequelae [6]. The biologic mechanisms leading to PTB are incompletely understood. Oxidative stress may represent one possible mechanism. Oxidative stress biomarkers have been associated with adverse pregnancy outcomes [7] and several studies have shown that oxidative stress biomarkers are increased among women who go on to experience PTB or shortened gestation. However, the strength of association remains inconsistent across studies and discrepancies may in part be due to differences in biomarkers used to measure oxidative stress.[8]

Catalase enzyme is one of most abundant antioxidant enzymes which represent first line of antioxidant defense against free radical. [9]

In this study catalase activity was measured in both preterm and term groups and the results revealed that its serum levels is significantly low in preterm groups in comparison with term group. This inverse association of catalase enzyme and preterm labor was proved in other studies [10, 11]. This results may be due to increase in antioxidant defense as compensatory mechanism against increase oxidative stress in term group. Tiffany A. Moore, et al. found no differences in catalase levels in preterm maternal or cord blood samples between preterm and term pregnancies [12].Ramkumar Menon, et al measure catalase level in maternal plasma and found its levels was high in preterm labor in comparison with term labor [13]. These deferent results remain inconclusive, but indicate that a deferent finding in deferent studies may be caused by deferent studies circumstances, environmental factor, personal characteristics, diseases and other factors.

SODs are endogenous antioxidant enzymes that are catalyze the dismutation of O2• to H2O2 and O2.[14]

In this study the SOD activity was measured in maternal serum of preterm and term groups and the results show significant high level in term group in comparison with preterm. That's agree with the result of other studies [13, 11] This results may be due to increase in antioxidant defense as compensatory mechanism against increase oxidative stress in term group, Or due to normal increase in SOD level in this period of pregnancy [15] In other reviewed studies, researchers measured SOD in the preterm mothers. Herway et al. study EcSOD in maternal serum and did not showed significant differences between term and preterm birth [16]. Gunko, Pogorelova and Linde find minor expressions of Cu/Zn-SOD in women with preterm birth in comparison with women with term birth [17]. In the other studies, the researchers did not find significant differences in EcSOD levels between TB and PTB in cord blood [18] or in protein expression for Cu/ZnSOD in the myometrial tissue [19]. These inconclusive results indicate that SOD may be associated with race/ethnicity, personal factors, disease and environmental factors.

By comparing SOD level between pregnancies presented by pPROM and pregnancies presented by uterine contractions the results revealed decrease its level in pPROM pregnancies the same as Ramkumar Menon, et al study [13]. That due to increase oxidative stress which cause decrease antioxidant. In other study by Eryn H. Dutta et al. SOD1 measured in fetal membranes and show higher level in PTB than in pPROM whereas SOD2 showed no significant difference between the two groups [20].

Catalase level was compared between pregnancies presented by pPROM and pregnancies presented by uterine contractions the results revealed no significant deference between two groups, this results may be due to increase oxidative stress in two groups that cause decrease in antioxidant level. Ramkumar Menon measure serum catalase and found that its level in pPROM pregnancies was higher than spontaneous preterm labor which highlights the ambiguity associated with marker analysis of oxidative stress.[13] Eryn H. Dutta et al. found that catalase was not significantly different in fetal membranes of pPROM and PTB. [20]

Also, Soydinc *et al.,* did find lower catalase levels in the vaginal wash fluid in pPROM compared to a matched control group. [12]

Davut Sinan KAPLAN, et al. study total oxidative status and total antioxidant status in maternal colostrum of primiparous and multiparous mothers. and No significant differences were determined between two groups. [21]

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Conflict of Interest: None

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