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Relationship Between Catalase Enzyme Activity and Malondialdehyde (MDA) Levels in Incomplete Abortion and Imminent Abortion

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ABSTRACT

Abortion is one of the obstetric complications that are often found in pregnant women. The cause of abortion is not known with certainty, but it is suspected that one of the causes is an imbalance of pro-oxidants and antioxidants that occurs during placentation. Catalase is an enzyme that functions to catalyze hydrogen peroxide (H2O2) preventing lipid peroxidation in cell membranes. Malondialdehyde (MDA) is a product of lipid peroxidation. This review plans to decide the connection between catalase protein movement and malondialdehyde (MDA) levels in the incidence of incomplete and imminent abortion. The research was conducted at the Government General Hospital dr. M. Djamil, Hospital dr. Reksodiwiryo, and the Biochemistry Laboratory of Andalas University, Padang, with a cross-sectional design. The sample amounted to 42 people, consisting of three groups, namely incomplete abortion, imminent abortion and normal pregnant women 20 weeks as a control group, which were taken using consetic utuve sampling technique. Blood was gathered from the review subjects by intravenous means and estimated with a spectrophotomete. Based on the Pearson test, there was a huge negative connection between's catalase protein movement and malondialdehyde (MDA) levels in the incidence of incomplete abortion (p=<0.05), and there was no significant correlation between catalase enzyme activity and malondialdehyde (MDA) levels in the incidence of abortion. imminent (p=>0.05). This study concludes that there is a significant negative correlation between catalase protein movement and malondialdehyde (MDA) levels, where low catalase protein movement can increase malondialdehyde (MDA) levels in the incidence of incomplete abortion.

Keywords: *Catalase enzyme activity, MDA levels, incomplete abortion, abortion imminent*

1. INTRODUCTION

Complications in pregnancy can start when the product of conception implants in the endometrium, which will continue throughout the pregnancy even until delivery, and it is found that around 10-20% of pregnancies are accompanied by complications. Abortion is defined as the termination of pregnancy either spontaneously or intentionally before 20 weeks of gestation or less than 500 grams.[1]

The world wellbeing association who gauges that overall, around 21 6 million fetus removals happened in 2008 and practically these early termination cases happened in non-industrial nations. The extent of early terminations in non-industrial nations expanded from 1995 to 2008 from 78% to 86%.[2]

The cause of abortion cannot always be determined, because generally, more than one factor plays a role. In general, the causes of abortion can be partitioned into fetal factors and maternal factors. Fetal factors such as chromosomal abnormalities are the cause of about 50% of spontaneous abortions, where the most common abnormality is autosomal trisomy (Eiben et al, 1990). Maternal factors that play a role such as maternal age, anatomical abnormalities, immunological factors, infections, chronic diseases, endocrine disorders, nutrition, use of drugs and environmental influences.[3]

With the development of research on the placenta, a theory has emerged that relates the oxidative stress that occurs during the placentation process with the pathophysiology of abortion. Until the end of the first trimester, the fetus develops in an atmosphere of physiological hypoxia to protect itself from the adverse also, teratogenic impacts of oxygen free extremists and to keep up with undeveloped cells in a pluripotent state. Until at least the 10th week, embryo nutrition is also obtained from endometrial gland secretions into the intervillous space. Oxidative stress itself will disrupt the placentation process. Expanded placental oxidative pressure is a factor in the pathogenesis of early premature delivery.[4]–[6]

The balance between the total levels of the enzymatic antioxidant catalase against the mechanism of free radical formation that increases during pregnancy may be important in the pathogenesis of this disorder. In a study at Belgaum General Hospital India, catalase levels in first-trimester pregnant women were 7.82 ± 2.84 IU/mg, while non-pregnant women were 8.13 ± 2.25 IU/mg.[7]

The expansion in free revolutionaries is described by an increment in the biochemical marker malondialdehyde (MDA). The existence of free radicals produced in the body is a physiological process. Cells produce several defences against this, events known as counteracting antioxidant defences (Clarkson and Thompson, 2000; Patil et al., 2006; 2008). These defence mechanisms are grouped into free radical scavenging and oxidation chain reaction. Superoxide dismutase (SOD), glutathione peroxidase (GSHPx), and catalase (CAT) are enzymatic antioxidants that break the oxidation chain so that they can reduce free radicals in cells and prevent damage caused by free radical oxidation.[8]

Based on the existing theory, due to increased ROS and free radicals that exceed the scavenging capacity of antioxidants, a condition called oxidative stress arises which can result in decreased catalase chemical movement and can also increase malondialdehyde (MDA) levels in the event of an abortion. However, not many authors have found research on the decrease in catalase enzyme activity (CAT) in the incidence of abortion, and there is no research linking catalase chemical movement with malondialdehyde (MDA) levels in the incidence of abortion. The reason for this review was to decide the relationship between catalase chemical movement and levels of malondialdehyde (MDA) in the incidence of incomplete and imminent abortion.

2. RESEARCH METHODS

This research is an observational analytic study with a comparative cross-sectional to determine the relationship between catalase chemical movement and levels of malondialdehyde (MDA) in the incidence of incomplete abortion and abortion imminent. This research was conducted in the Midwifery Inpatient Room of the Government General Hospital dr.M.Djamil Padang, Tk III Hospital dr. Reksodiwiryo Padang, Biochemistry Laboratory, Andalas University, Padang.

The population of this study were pregnant women who had been diagnosed by an obstetrician with incomplete and imminent abortions. By using the control group, namely normal pregnant women with gestational age 20 weeks. The research subjects selected were all populations that met the inclusion and exclusion criteria. Inclusion criteria in this study were pregnant women with gestational age 20 weeks diagnosed by dr. Sp.OG experienced incomplete and imminent abortion, and the control group was normal pregnant women 20 weeks. Exclusion criteria were mothers with moles, uterine abnormalities, uterine myomas, history of provocating abortion and habitual abortion. The number of each sample in each group is 14 samples so that the total minimum number of samples required is 42 samples. Sampling was done by consecutive sampling.

Examination of catalase chemical movement and malondialdehyde (MDA) levels was carried out by taking 3 cc of median cubital venous blood with a 3 ml syringe, then centrifuged and then measuring catalase chemical movement and malondialdehyde (MDA) levels by spectrophotometric method. The data were analyzed using Pearson's test to see the relationship between catalase enzyme activity and malondialdehyde (MDA) levels in the incidence of incomplete abortion and abortion.

3. RESULT

Table 1. Characteristics of Research Subjects in the Incomplete Abortion, Imminent Abortion and Normal Pregnancy Group 20 Weeks

Characteristics	Group			*p*-Value
	Abortus Inkomplit (n= 14) Mean±SD	Abortus Imminens (n= 14) Mean±SD	Kehamilan Normal (n= 14) Mean±SD	
Age (Years)	31,50±5,81	31,86±7,41	26,43±3,92	0,03
Gestational Age (weeks)	9,00±2,99	9,14±2,45	11,86±5,41	0,10
Parity	2,64±1,34	2,36±1,01	1,79±0,70	0,09

Table 1 shows that the mean age of the mother in the incomplete abortion group was 31.50 ± 5.81 years, the imminent abortion group was 31.86 ± 7.41 years and the normal pregnancy group was 26.43 ± 3.92 years. Statistical test results obtained p-value = 0.03 means at p <0.05 it tends to be presumed that there is a huge distinction between the three groups. Based on gestational age, the three groups showed the mean gestational age in the incomplete abortion group was 9.00 ± 2.99 weeks, in the imminent abortion group 9.14 ± 2.45 weeks, while the normal pregnancy group was 11.86 ± 5.41 weeks. Statistical test results obtained p-value = 0.10 means at p <0.05 it tends to be presumed that there is no critical contrast between the three groups. Meanwhile, based on parity, the mean equality of moms in the fragmented fetus removal bunch was 2.64 ± 1.34, in the imminent abortion group it was 2.36 ± 1.01, while the normal pregnancy group was 1.79 ± 0.70. The results of the statistical test showed that the value of p = 0.09 means that at p<0.05, it very well may be reasoned that there is no huge contrast between the three gatherings.

It can be concluded that there was a significant difference in maternal age between the incomplete abortion group, imminent abortion, and normal pregnancy 20 weeks with p-value = <0.05, and there was no critical contrast in mean parity and gestational age between the incomplete abortion group, abortion group. imminent, and normal pregnancy 20 weeks.

To determine the relationship between catalase enzyme activity and malondialdehyde (MDA) levels in incomplete abortion, the Pearson correlation test with normal data distribution can be seen in Table 2 below:

Table 2. Relationship between Catalase Enzyme Activity and Malondialdehyde (MDA) Levels in Incomplete Abortion

Variable	Correlation (r)	*p*-Value
Catalase Enzyme Activity with MDA Levels	-0,80	0,01

In the results of table 2 above, based on the results of the analysis with the Pearson statistical test, the value of p = 0.01 (p <0.05), the conclusion from these results is that there is a correlation between catalase chemical movement and malondialdehyde (MDA) levels in incomplete abortions. And the value of r = -0.80 indicates that there is a very strong negative correlation between catalase protein movement and malondialdehyde (MDA) levels in incomplete abortions.

To determine the relationship between catalase protein movement and malondialdehyde (MDA) levels in abortion imminent, the Pearson correlation test was used with normal data distribution, presented in the following table:

Table 3. Relationship Between Catalase Protein Movement and Malondialdehyde (MDA) Levels in Abortion Imminent

Variable	Correlation (r)	*p*-Value
Catalase Enzyme Activity With MDA Levels	0,24	0,40

In the results of table 3 above, based on the results of the analysis with the Pearson statistical test, the value of p = 0.40 (p <0.05), the end from these outcomes is that there is no connectionbetween catalase protein movement and malondialdehyde (MDA) levels in abortion imminent, and obtained value of r=0.24

4. DISCUSSION

4.1 Relationship Between Catalase Protein Movement and Malondialdehyde (MDA) Levels in Incomplete Abortion

In this study, based on the results of the analysis with the Pearson statistical test, it was obtained r = -0.80 and p-value = 0.01 (p <0.05). This means that there is a negative correlation between the decreased activity of the catalase enzyme and the increased levels of malondialdehyde (MDA) in the incidence of incomplete abortion.

In pregnancy, catalase assumes a vital part. In early pregnancy, catalase assumes a part in the endometrium for fruitful implantation by shielding the blastocyst from superoxide revolutionaries.[9] Oxidation reactions increase in the late secretory stage not long before monthly cycle and decrease in early pregnancy, especially in the decidua. Catalase activity movement diminishes in the late secretory stage but increases in the decidua in early pregnancy. These findings indicate that catalase plays a very important role in the stability of endometrial tissue as SOD increases where these two antioxidants act synergistically.[10] For the placenta, catalase plays a role in protecting it from lipid peroxidase. Lipid peroxidase causes cell damage through enzymatic reactions, converting unsaturated fatty acids into lipid peroxides, which will disrupt cell membrane stability and induce cell damage. In ordinary pregnancy, lipid peroxidase will decrease while catalase increases according to increasing gestational age.[11]

The results of this study are by research by Patil et al (2006) who discovered that MDA levels in pregnant women were higher than in non-pregnant ladies. The increment in MDA levels expanded in accordance with gestational age, to be specific from the main, second, and third trimesters, on the contrary, there was a decrease in antioxidants SOD, GPx, and catalase in pregnant ladies contrasted with non-pregnant ladies. Patil et al (2006) also reported MDA levels in non-pregnant women: 1.19±0.09 nmol/ml while pregnant women in the I, II, III trimesters were 1.42±0.13 nmol/ml, 1.64±0,14 nmol/ml, 1.79±0.14 nmol/ml. This is because serum MDA is a product of lipid peroxidation which is a receptive aldehyde, and is a responsive electrophile animal groups that causes toxic stress in cells. High MDA serum concentration indicates an oxidation process in the cell membrane. MDA can react with deoxyguanosine and deoxyadenosine in DNA and form the mutagenic substance M1G. Free radicals are very reactive and unstable, so it is very difficult to measure them directly. However, the formation of lipid peroxide can be used to indirectly determine the presence of these free radicals.[12]

The results of this different study were carried out by Kobe, et al. (2002) found that there was a decrease in MDA levels in the group of pregnant women who received exercise throughout their pregnancy compared to those whose exercise activities were interrupted. Wagey in 2011 reported a study of 66 pregnant women who wanted to know the impact of light exercise in reducing oxidative damage in 30 pregnant women as controls and the rest received treatment as a case group. The results showed, with light exercise activity during pregnancy starting at 20 weeks of gestation, there was a decrease in malondialdehyde levels and a decrease in 8-hydroxy-2-deoxyguanosine levels compared to no activity (p<0.05), and it was found that there was an increase in levels of the enzymatic antioxidant, SOD. , GSHPx, and CAT in pregnant women who received pregnancy exercise since the gestational age entered the age of 20 weeks. The difference in this study is that this research is accompanied by pregnancy exercise and sports.

Specific studies examining the levels of the enzymatic antioxidant catalase in incomplete abortion have not been found, but some literature suggests that if the catalase level decreases, the free radicals produced cannot be completely bound so that more H2O2 is framed and changed over into hydroxyl extremists that cause harm. on the cell membrane. So that the formation of covalent bonds between free radicals and lipids in cell membranes (lipid peroxidation). Malondialdehyde (MDA) is a result of lipid peroxidation. Damage to the cell membrane that occurs can progress to cell death.[4]

In two-thirds of abortion cases, there is anatomic evidence of an effect on placentation characterized by a thinner or more fragmented trophoblast protective layer, invasion of the endometrium by decreased trophoblast and incomplete occlusion of the spiral artery ends. This is related with the shortfall of physiological changes in a large portion of the winding conduits

and causes the untimely beginning of maternal flow all through the placenta. So the free radicals produced by the incipient organism can't be bound flawlessly so that more H2O2 is shaped and changed over into hydroxyl revolutionaries that can harm DNA. In the event that the DNA harm that happens can't be fixed by DNA fix systems, the cellwill enter the apoptotic pathway and cell death occurs, which in the fetal stage, this death will trigger the body's response to expel the products of conception, resulting in abortion.[13]

Based on this research, it can be analyzed that a decrease in catalase enzyme activity and an increase in malondialdehyde (MDA) levels, one of the causes is due to an imbalance between oxidants or free radicals and antioxidants to prevent oxidative stress. Therefore, we need antioxidants that can work where ROS are formed. In pregnancy where the syncytiotrophoblast is a site that has fewer antioxidants so it is very sensitive to increased oxygen which has the potential to cause a condition of oxidative pressure. The increment in MDA levels was joined by a lessening in the cancer prevention agent movement of catalase. This is also caused by an increase in excessive levels of ROS so that it exceeds the capacity of catalase which can further cause oxidative stress and cause damage to various macromolecules in cells (oxidative damage). An addition in MDA levels demonstrates an increase in lipid oxidative damage due to hypoxia.

For this reason, prevention is needed by conducting Ante Natal Care (ANC) examinations during pregnancy by conducting assessments, especially in mothers who have risk factors to reduce the occurrence of abortion. In abortion, many biomolecular examinations can assist in establishing the diagnosis of abortion, one of which is by examining catalase protein movement and malondialdehyde (MDA) levels.

4.2 Relationship Between Catalase Protein Movement and Malondialdehyde (MDA) Levels in Abortion Imminent

In this study, based on the results of the analysis with the Pearson statistical test, it was obtained r = 0.24 and p-value = 0.40 ($p < 0.05$). It is concluded that there is no correlation between catalase protein movement and malondialdehyde (MDA) levels in the incidence of abortion imminent.

In this study, there was no specific research linking catalase protein movement and malondialdehyde (MDA) levels in the incidence of abortion imminent. Research on the relationship between antioxidants and oxidative stress provides another comprehension of the materno-fetal relationship in the first trimester, suggesting that the placenta functions as a barrier to oxygen supply during organogenesis. Although the fetus has begun to implant into the endometrium from 6-7 days after fertilization and is fully implanted on the 10th day, adequate blood flow does not occur until the end of the first trimester, around the 10th week. The intraplacental partial pressure of oxygen (PO2) is 2-3 times lower at 8-10 weeks compared to after 12 weeks. Thus, until the end of the first trimester, the fetus develops in an atmosphere of physiological hypoxia to protect itself from the adverse furthermore, teratogenic impacts of oxygen free revolutionaries, and to keep undifferentiated organisms in a completely pluripotent state. At physiological levels, free extremists function in the regulation of various cell functions, especially as transcription factors.[14]

The formation of the uteroplacental vascular system begins with the invasion of the maternal decidua by extravillous cytotrophoblasts. It consists of 2 successive processes and the success of these two processes will affect the pregnancy outcome. The process that occurs first is the extravillous cytotrophoblast covering the outer wall of the trophoblast capillary and the intra-endometrial branch spiral arteries, thus forming a cap on the blood vessel. This blockage acts as a filter allowing plasma to diffuse into the intervillous space instead of true blood flow. This invasion occurs around weeks 5 to 8. This flow is augmented by uterine gland secretions that are released into the intervillous space until about 10 weeks of gestation. At weeks 8 to 13, this blockage will slowly release. Then a second trophoblast invasion occurs against the intramyometrial spiral arteries (at weeks 13 to 18).[15]

In spontaneous abortion, there is a deficiency of placentation. There was a failure in the second wave of trophoblast invasion. So that physiological changes in the spiral arteries do not occur. Changes occur only in the decidual segment spiral arteries, while the myometrial segment spiral arteries are still covered by smooth muscle cells. In addition, there was also found hyperplasia of the tunica media and platelets. The diameter of the spiral arteries is smaller than in normal pregnancy.[14] This causes resistance to blood flow to increase and ultimately leads to insufficiency and

ischemia. Some of the spiral arteries in the decidua and myometrium are blocked by fibrinoid material, contain foam cells, there is an accumulation of macrophages filled with fat and perivascular mononuclear cell infiltration.[16]The occurrence of abortion is also due to inadequate trophoblast invasion so that the formation of trophoblastic oxidative stress causes the relationship between the products of conception and the spiral arteries do not occur properly and perfectly. Therefore, a balance between oxidants or free extremists and cell reinforcements is expected to forestall oxidative pressure.[17]

Another theory suggests that the process of starting abortion is also caused by inadequate trophoblast invasion so that the formation of trophoblastic oxidative stress causes the relationship between the products of conception and the spiral arteries do not occur perfectly.[17] Pregnancy experiencing placenta oxidative stress also has implications for spontaneous abortion.[18] The increase in free radicals in the first trimester of pregnancy has a major role in the occurrence of abortion. Free radicals are unstable so it is very difficult to measure them directly. However, its tendency to form lipid peroxidation can be used to indirectly determine the presence of these free radicals. Lipid peroxidation markers, such as Malondialdehyde (MDA) can be measured to determine the presence of free radical damage.[8], [12]

Based on this research, it can be analyzed that the mechanism that causes abortion cannot always be determined, because generally, more than one factor plays a role. In general, the causes of abortion can be divided into fetal factors and maternal factors. Fetal factors such as chromosomal abnormalities are the cause of about 50% of spontaneous abortions, where the most common abnormality is autosomal trisomy.[19]Maternal variables that assume a part like maternal age, anatomical abnormalities, immunological factors, infections, chronic diseases, endocrine disorders, nutrition, use of drugs and environmental influences.[3] And based on the characteristics of the mother's age in this study, the mean age of the mother in the incomplete abortion group was 31.50 ± 5.81 years, the imminent abortion group was 31.86 ± 7.41 years and the normal pregnancy group was 26.43 ± 3.92 years, there was a significant mean difference between the three groups p=0.03 (<0.05). It can be concluded in this study that maternal age is one of the causes of abortion imminent. From the data, the average age of pregnant women is mostly in the reproductive age period (20-35 years).

5. CONCLUSION

1.There is a negative correlation between catalase protein movement and malondialdehyde (MDA) levels in the incidence of incomplete abortion.

2.There is no correlation between catalase protein movement and malondialdehyde (MDA) levels in the incidence of abortion imminent.

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