International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

The Result of Antioxidant System in Coronary Artery Deficiency

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Abstract—*Background: Recently years, increasing coronary artery disease in the worldwide. An estimated 17.9 million people died from cardiovascular disease (CVD) in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke, reported WHO. Myocardial infarction is invariably followed by numerous pathophysiological and biochemical alterations including hyperlipidemia, thrombosis, lipid peroxidation and free radical damage etc., leading to qualitative and quantitative changes of myocardium. Determination of in blood serum and cardiac tissue homogenate levels of cardiac biomarker cardiac specific troponin I and estimation of some antioxidants enzymes of experimental acute infarction model induced by coronary artery occlusion in rats. Materials and methods: Adult male Wistar rats, weighting approximately 180 to 200±20 gram, used for the experiment. We did coronary occlusion induced myocardial ischemia by Kogan A.K., Ambaga M /1979/'s method. The experiment is 1st, 3rd, 7th, 14th 21st days blood samples were collected and used to determine in blood serum and cardiac tissue homogenate levels of cardiac biomarker cardiac specific troponin I (CT_n-I) and estimation of some antioxidants enzymes (SOD, GSH, GSH-px) were estimated using standard rat ELISA KIT by enzyme-linked immunesorbent assay. Result: Determination of cardiac troponin-I levels in blood serum of experimental acute infarction model induced by coronary artery occlusion in rats increased by 31.9-58.4% in the 1st, 3rd, 7th, 14th 21st days of the test compared to healthy groups. The cardiac biomarker cardiac specific troponin I is indicative for cardiomyocyte damage and is currently used in the diagnosis and prognosis of myocardial ischemia. It is also shown that substances such as endogen and antioxidant decreases in heart ischemia. Conclusion: Determination of decreased level are antioxidants (SOD, GSH, GSH-px) in blood serum of experimental acute infarction model induced by coronary artery occlusion in rats, it seems to induced of pathogenesis of coronary disease and infarction myocardium while the accumulation of lipid product cause to damage the cell membrane.*

Keywords—*Myocardial infarction; Antioxidant; Electron and proton conductance.*

I. INTRODUCTION

Recently years, Increasing coronary artery disease in the worldwide. An estimated 17.9 million people died from CVD in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke, reported WHO. [1,2]. It is a process of narrowing coronary arteries overtime involved at all stages of the atherosclerotic process, from lesion initiation to plaque rupture. In the past few years, inflammation has emerged as a major driving force of atherosclerotic lesion development. [3]. Both MI and heart failure remain major causes of mortality and morbidity [4]. Epidemiological studies indicate that ischemic heart disease (IHD) will constitute the major disease-burden worldwide by the year 2020 [5]. Full necrosis zone, which formed during 30 minutes after shortage of donators and acceptors, where occurred the complete stop of clockwise normal flow of electrons and protons is characterized by irreversible stop of electron and proton conductance [6]. Troponin complex is a component of skeletal and cardiac muscle thin filaments. It consists of three subunits troponin I, T, and C, and it plays a crucial role in muscle activity, connecting changes in intracellular Ca^{2+} concentration with generation of contraction. This review summarizes the existing evidence on the structure and function of troponin complex subunits, their role in the regulation of cardiac muscle contraction, and their clinical applications.[7] It has also been suggested that oxidative stress produced by free radicals or reactive oxygen species (ROS), as evidenced by marked increase in production of lipid peroxidative products associated with decreased levels of antioxidants such as superoxide dismutase (SOD), catalase (CAT) and reduced glutathione (GSH), plays a major role in myocardial damage during MI [8,9]. We did coronary occlusion induced myocardial ischemia by *Kogan A.K, Ambaga M. /1979/*'s method. [10] Although a variety of surgical manipulations have been used during the past decade to induce the ischemic event, permanent left anterior descending artery (LAD) occlusion is the most common model used by researchers[11,12].

The rarity of comparative research of lipid oxidation intensity and antioxidant system to pathogenesis mechanism of coronary deficiency through cardiac troponin I, superoxide dismutase, glutathione, glutathione peroxidase enzymeation around heart tissue homogenate and blood serum liquid (2 nd compartment) during the coronary artery disease of the experimental subject has become the basis of our research.

II. MATERIALS AND METHODS

The experiment was conducted on "The innovation research, bio-modeling laboratory of "New Medicine" Medical University, ELISA laboratory of Hulj-Borjigon hospital". Adult male Wistar rats, weighting approximately 180 to 200±20 gram, were using for the experiment. They were divided randomly into 2 groups (6-8 animals in each group). They were distributed as follow: first group (healthy, non treatment), second group (control, experimental acute infarction model induced by coronary artery occlusion in rats, non treatment). All animals supplied with standard food during the experiment with an access of water. Experimental

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procuders were conducted in accordance with the regulations of Animal Ethical committee. We did coronary artery occlusion induced myocardial ischemia by *Kogan A.K., Ambaga M. /1979/*'s method [10].

Estimation of some antioxidants: The experiment is 1st, 3rd, 7th, 14th 21st days blood samples were collected and used to determine the serum and cardiac tissue homogenate levels of cardiac biomarker cardiac specific troponin I in (CT_n-I), superoxide dismutase (SOD), glutathione (GSH), glutathione peroxidase (GSH-px) were estimated using standard rat ELISA KIT by enzyme-linked immunesorbent assay (Shanghai MLBIO Biotechnology Co.Ltd, China).

III. Results

The experiment is 1st, 3rd, 7th, 14th 21st days blood samples were collected and used to determine in blood serum and cardiac tissue homogenate levels of cardiac biomarker cardiac specific CT_n-I and antioxidants (SOD, GSH, GSH-px) were estimated using standard rat ELISA KIT by enzyme-linked immunesorbent assay.

TABLE 1. The levels of cardiac biomarker cardiac specific troponin I (CT_n-I) during coronary artery deficiency

№	Days of experiment, group (s)	CTn-I (ng/L)	
		Healthy	Control
1	1 day	11.16±0.361	26.84±0.871*
2	3 day	12.85±0.192	22.95±1.137*
3	7 day	12.66±0.235	21.12±0.741*
4	14 day	12.4±0.32	18.22±0.436*
5	21 day	11.98±0.32	21.55±0.629*

*- When compared control group measurements with healthy group P≤ 0.05, P≤ 0.001

As shown in Table 1, Determination of CTn-I concentration in cardiac tissue homogenate of control group (experimental acute infarction model induced by coronary artery occlusion in rats) animals had increased 31.9-58.4% during 1-21 days, and have been maintained stable during either acute and chronic stage (P≤0.001 This indicates that the coronary artery disease or myocardial infarction (cardiac muscle necrosis) causes dysfunction in the interaction between actin and myosin of heart muscle during the heart ischemia and decomposed heart muscle cells becoming dead cell making the decaying area bigger.

TABLE 2. The result of some biomarker of antioxidant during coronary artery deficiency

№	Days of experiment, group (s)	SOD (pg/ml)			
		1 day	3 day	14 day	21 day
1	Healthy	7.96±0.22	8.21±0.09	7.74±0.05	7.69±0.18
2	Control	5.78±0.23*	5.58±0.27*	3.49±0.14*	4.68±0.18*

*- When compared control group measurements with healthy group P≤ 0.05, P≤ 0.001

As shown in Table 2, During 1-21 days of experiment, non-treatment control group cardiac tissue homogenate SOD enzyme concentration activity have decreased by following sequence of 27.38%, 32.03%, 54.9%, 39.1% (P≤0.001). The decrease in the true value of statistics shows that during the acute and chronic insufficiency of oxygen, the normal flow of electron and proton in heart tissue and cell gets disrupted and insufficiency in high energy compounds such as ATP and NADPH around the area of mitochondrial membrane leads into overstimulation of oxidant which causes drastically high consumption rate of endogen antioxidant enzymes such as catalase, superoxide dismutase, vitamin E, and glutathione peroxidase.

TABLE 3. The result of glutathione during coronary artery deficiency

№	Days of experiment, group (s)	GSH (ng/L)				
		1 day	3 day	7 day	14 day	21 day
1	Healthy	150.22±2.488	145.81±1.935	151.08±1.374	147.93±0.71	149.23±1.155
2	Control	128.40±2.68*	113.38±5.873*	123.05±2.993*	112.42±2.805*	126.94±2.471*

*- When compared control group measurements with healthy group P≤ 0.05, P≤ 0.001

As shown in Table 3, During 1-21 days of experiment, determination of GSH levels in cardiac tissue homogenate of experimental acute infarction model induced by coronary artery occlusion in rats decreased by following sequence of 14.5%, 22.2%, 18.5%, 24%, 14.9% of the test compared to healthy groups, p≤0.001. Comparing the healthy groups to subject group, a decrease in the source of clear glutathione shows that during the heart ischemia over-oxidation of fatty substances gets strongly stimulated and free radicals in the heart cell increase significantly. Following this phenomenon, the protection system from endogen antioxidant gets fully mobilized which allows the condition of decreasing clear compounds such as glutathione.

As shown in Table 4, Determination of GSH-Px levels in blood serum of experimental acute infarction model induced by coronary artery occlusion in rats decreased by 57.3-63.5% in the 7-21 days of the test compared to healthy groups p≤0.001. Also, it shows that during both acute and chronic coronary artery disease, over stimulation of fatty oxidant and accumulation of toxic fatty hydrogen peroxide around the tissue and cell causes high need of antioxidant containing seen arises.

TABLE 4. The result of glutathione perioxidase during coronary artery deficiency

№	Days of experiment, group (s)	GSH-Px (pmol/ml)	
		Healthy	Control
1	7 day	5.18±0.16	2.21±0.121*
2	14 day	5.66±0.01	2.21±0.11*
3	21 day	6.01±0.094	2.19±0.136*

*- When compared control group measurements with healthy group P≤ 0.05, P≤ 0.001

Morphological assessment of ischemic damage myocardium rats control group after ligation of the coronary artery. (shown in Fig 1.)

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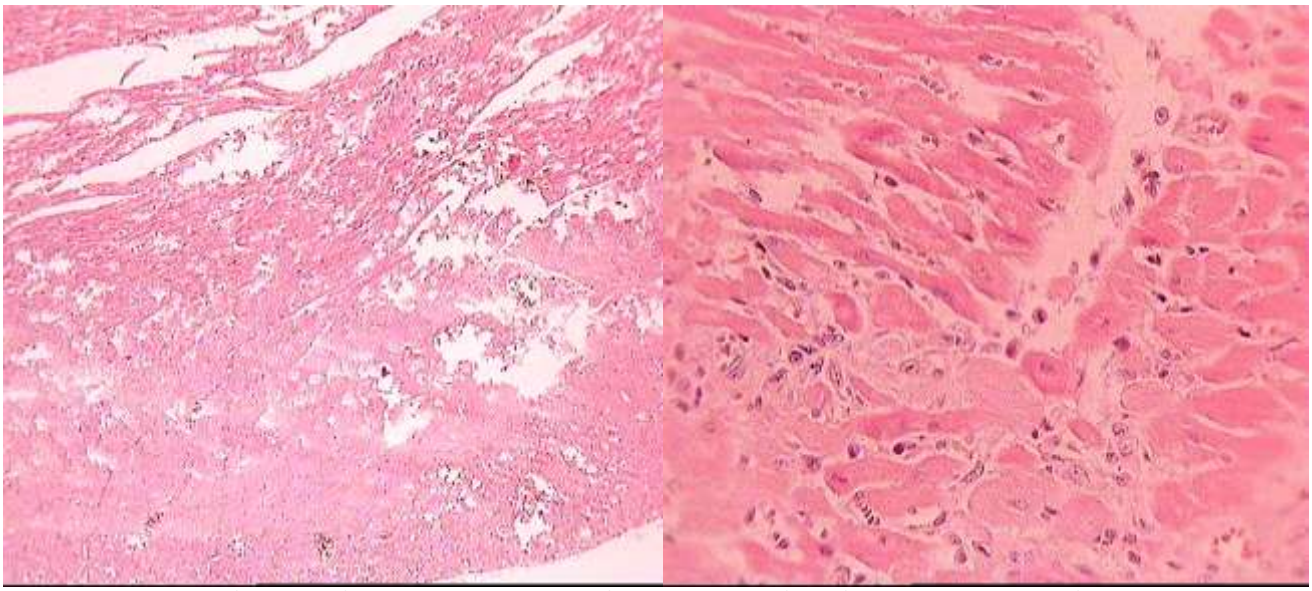

Fig. 1. Myocardium, left ventricle of the heart control rats 3 days after transplantation of the left coronary artery. A-Site of necrosis, delamination, tearing and fragmentation of fibers. B-Myocardial edema, cardiomyocyte necrosis, sarcoplasma decay: dystrophy of cardiomyocytes, leukocyte infiltration. Hematoxylin and eosin stain. Magnification: A x 100; B x 400. Histology conclusion: Myocardial necrosis (Acute myocardial infarction)

IV. Discussion

Recently years, An estimated 17.9 million people died from cardiovascular deseases in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke, reported WHO [2]. For our research, we identified serum and heart tissue substances in severe, acute and chronic phase of coronary artery disease and did comparative study with other researchers' research. The most unique heart biomarker that identifies the heart muscle cell's damage or necrosis is cardiac troponin I protein and it is still used in identifying heart attack caused by insufficient blood flow and identifying the seriousness of the cause *(Tallaj JA, Franco V, Rayburn BK, et all 2005)* [13]. After injecting the cardiac troponin I into the both healthy and subject group in 1st, 3rd, 7th, 14th 21st days after creating the coronary artery disease in test experiment, the statistics increased 31.9-58.4% positive. Also it indicates that during the severe, acute and chronic phase, expansion of necrosis area around the heart muscle matches with the result of previous researchers. Researchers also noted that lack of enzymes such as catalase and superoxide dismutase can cause harmful effects on the healthy cells or tissue [14]. Based on the stimulation of superoxide dismutase, glutathione, and glutathione peroxide enzymes that indicates body protection system endogen and antioxidant decreases in tissue and serum level which results in stimulation of some pathogenesis mechanism of coronary artery disease that further destroys cell and tissue.

V. Conclusion

Determination of decreased level are antioxidants in blood serum of experimental acute infarction model induced by coronary artery occlusion in rats, it seems to induced of the pathogenesis of coronary disease and infarction myocardium while the accumulation cause to damage the cell membrane.

Acknowledgements

We are grateful to our study consultant Doctor of Medical Science, Professor Ambaga.M who helped to conduct our study, supervisor of our study Doctor of Medical Science, professor Sarantsetseg.B, supervisor of our study Doctor of Medical Science, professor Amgalanbaatar. D, Doctoral student Ariuntsetseg. B, Oyuntsetseg.S, Munkhbayar.S, Jigjidnorov.M, employees of Research – Innovation center of "New Medicine" Medical University and "Bio-design laboratory".

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