Study of Mean Platelet Volum When Exposed to Ultrasound Waves for Hypertension Patients

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Abstract

Platelets are one of the most important cells in human blood, and help control bleeding. Mean platelet volume (MPV) play a vital role to indicate the activation of platelets. any significant changes of mean platelet volume will effect on platelet activity. Vibration-stimulats changes in the platelets activity as a type of stress upon MPV. This study aimed to investigate the impact of ultrasound waves on MPV of healthy and hypertension subjects in vitro model study. Venous blood samples obtained from healthy subjects (n=43) and hypertensive patients (n=61) have been exposed to ultrasound waves for two periods (5-10) minutes. The MPV was measured using the Coulter electronic count (Complete blood Count). The results have been showen that ultrasound waves caused a significant changes MPV in healthy subjects and hypertensive patients. The changes in the MPV are dependently related to the exposure time. In healthy subjects, the MPVs have been significantly increased by 12.6% for 10-min exposure while in hypertensive are significantly decreased by 9.1% for 10-min. It concludes that ultrasound induced an increase of the MPV, and this effect is tended to be less in patients with hypertension indicated that the responses of platelets are reduced in chronic diseases. It is clearly indication that the cellular response of MPVs in hypertension patients were very weak may because of hypertension. Whereas, MPVs response of healthy subject remained normal and effective.

Keywords: *Vibration, Platelets, Hypertension, Mean platelet volume (MPV), Ultrasonic waves.*

Introduction

Platelets are the most important vital cells in human blood. which are small nucleate cells play a critical role by helping the body form clots to stop bleeding. If one of the blood vessels is damaged, the body sends signals that are captured from the blood platelets to stop the bleeding by adhesion process, because when the platelets reach the site of infection, they grow sticky claws that help to adhere, and they send chemical signals to attract more Platelets to accumulate on the thrombus. Human body consist of 1×1011 of plateletswhich formed every day as the result of complex processes of differentiation, maturation and fragmentation of megakaryocytes [1]. Platelets are diferent in volume, density and reactivity individually [2]. The range of normal platelet counts is 150–400×109/L. Naturally, platelets spread in blood stream for 8–10 days while upon vascular injury, platelets instantly adhere to the exposed extracellular matrix resulting in platelet activation to form hemostatic plug. If the platelet number is low, the risk of bleeding is high [3].

Mean platelet volume (MPV) is a signal for platelet activaty. Furthermore, altitude of MPV values is important, To be considered as a vital indicator for detect chest pain that is due to myocardial infarction, from that of non- cardiac one [4]. In addition, MPV is predictor marker for ventricular dysfunction and clinical outcome of acute myocardial infarction [5].

In case of hypertension, studies found that MPV being an independent factor which related with morning blood pressure rise also high sensitivity C-reactive protein and therefore, which may serve as a predictor atherothrombotic cardiovascular event [6]. Numerous studies noted that the workers who exposed to local vibration have a significant low of lipid profile involving triglycerides, serum cholesterol and high density lipoprotein at the same time the viscosity of blood will increase [7]. Studies related with animals which exposed to vibration exercise for short period in-vivo have been noted that there is no significant changes in hematological indices [8].

One types of mechanical energy form is Ultrasound waves which is a mechanical vibration, longitudinal waves composed of compression and rarefaction areas. Particles of a material which exposed to a ultrasound wave will fluctuated around a fixed point rather than move with the wave itself. When the energy within the sound wave is transfered to the material, it will lead to oscillation of the particles of that material. Clearly any increasing in the molecular vibration in the tissue can result in heat generation, furthermore, ultrasound can used to produce thermal changes in the tissues, although current usage in therapy does not focus on this phenomenon [9], [10].

Of general principles that the temperature expands biological material [11]. Based on this rule our study has been conducted to investigate in mean platelet volume response when exposed to ultrasound waves for healthy as a control and hypertension patients in-vitro model becuse the ultrasound waves may cause altering in MPV when exposed to the physical injury like vibration sound.

Materials and Method

This study was done in University of Diyala/ college of medicine from october 2019 to january 2020. An agreement form has been obtained from each patient before starting our study. This study has been conducted according the ethical guidelines constructed by the Scientific Committee of the Institute. The patients were recruited from the hospital. A total number of 102 patients were enrolled in the study; 61 patients with essential hypertension and 43 healthy patients. 3ml of peripheral venous blood have been drawn and putted into EDTA-tubes then each tube was exposure to ultrasound vibration (sonoscape s50)for 5 minutes and for 10 minutes. The blood was used directly after its withdrawal. Initially the blood was examined before it was exposed to ultrasound, then the blood model was exposed to ultrasound in a precise way where the probe covered all the area of blood which exist in EDTA tube. The platelet number (per cubic millimeter) and the mean platelet volume (fl) were measured for each sample before and after exposure to the vibration using Coulter (diagon Ltd, D-Cell 60) AUTO HEMATOLOGY ANALYZER apparatus.

Statistical Analysis

Data of current study were analyzed by using Chi-square (X^2) test to compared between percentages. Also, measured sensitivity and specificity of mean platelets volume (MPV). Numeric data were described by (Mean ± SD). T test used to compare between two numeric variables, while F test (ANOVA) used to compared between three numeric variables or more. A level of significance of α=0.05 was applied to test. (SPSS v.22 and Excel 2013) programs used to analyze current data.

Results

104 volunteers was participated in our study grouped into two groups (43 subjects were healthy as a control and 61 subjects was hypertension). The mean age of study volunteers was significantly 34.30±11.34 year for control individuals and 53.59±15.31 with range of 1-80 years. Mean and standard deviation values of the BMI for control individuals 26.90±4.78 and 27.33±4.59. According to residence 77% of hypertention individuals were urban and 61% of healthy individuals were urban as show in (Table1).

Table (1) comparison between anthropometric characters between study groups by using X^2 test.

			Groups		Total	Statistics
			Controls (43)	Patients (61)		
Age_periods	1-20	N	3	1	4	X 2= 33.34 Df=5 P=0.001***
		%	7.0%	1.6%	3.8%	
	21-40	N	30	12	42	
		%	69.8%	19.7%	40.4%	
	41-60	N	9	29	38	
		%	20.9%	47.5%	36.5%	
	61-80	N	1	17	18	
		%	2.3%	27.9%	17.3%	
	>80	N	0	2	2	
		%	0.0%	3.3%	1.9%	
BMI_periods	<25	N	14	14	28	X 2= 1.840 Df=2 P=.399
		%	32.6%	23.0%	26.9%	
	25-29	N	17	23	40	
		%	39.5%	37.7%	38.5%	
	≥30	N	12	24	36	
		%	27.9%	39.3%	34.6%	

Befor starting with our investigation, MPV have been checked for controls and hypertension cases as showen in (Table 2), MPV values in heathy subjects and Hypertension cases nearly the same and no difference appear in statistics. after that, the blood have been exposed to ultrasound for 5min and MPV checked again. We found that mean platelets volume started to significantly increasing in controls and decrease in patients with (hypertensive) groups (T=4.717 Df=93 P=0.001). then, the blood exposed again to ultrasound for 10min, surprisingly, MPV response for healthy subject showed significantly increasing comparing with hypertension values(T=8.235 Df= 93 P=0.001). Moreover, the MPV of hypertension patients have been noted a significantly decreasing.

Table (2) :-Mean platelets volume(MPV) Before and After exposure to Ultrasonic Waves in study groups.

Groups		N	Mean	SD	Statistics
Before	Controls	43	8.64	0.89	T=1.012 Df=93 P= 0.31
	Patients	61	8.45	1.01	
After_5_minutes	Controls	43	9.04	0.86	T=4.717 Df=93 P=0.001***
	Patients	61	8.19	0.96	
After_10_minutes	Controls	43	9.40	0.91	T=8.235 Df= 93 P=0.001***
	Patients	61	7.80	1.05	

Interestingly, MPV response in hypertension patients was different during the time periods Where the response was inversive compared to a MPV response in healthy subjects, there was a significantly decreasing when increasing time periods of exposure to ultrasound waves. as shown in (Figure 1).

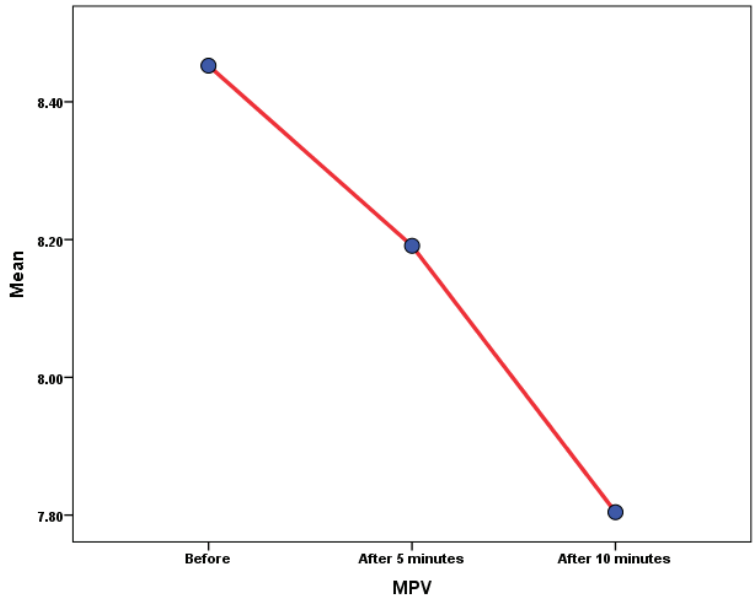

Figure (1):- Degree of MPV differences in patients study group according to time of exposure to ultrasonic waves. (p<0.005)

Discussion

The results of our study showed that ulterasound has sever adverse impacts on mean platelet volum (MPV) Regardless of weight and age particularly on hypertension patients.

There are many researches underwent in the past indicating the bioeffects of ultrasound waves and its benefits in can promote satellite cell proliferation, achieve collagen supra-molecular myoregenerationbphase, increase the differentiation of muscle lineage,reduce oxidative stress and treatment of idiopathic thrombocytopenic purpura [12-15].

On the other hand, many studies indicating the hematological changes due to exposure to ultrasound [16, 17].and this in agreement with the results of the present study that show the MPV of hypertensive patients affected by ultrasonic waves rather than healthy individuals as the platelets decrease in size and this goes with other studies who demonstrated that hypertensive patients exposed to ultrasound at work have an increase in platelets aggregation with increased generation and activity of von Will brand factor.

Study underwent on discoid platelets suspension when exposed to ultrasound waves ,changes in platelets orientation and damage to platelets occurs after 5 minutes of exposure and damage to the cells is directly proportional to the intensity and duration of time exposure[18-20] and this also in agreement with our study results as the MPV of hypertensive patients decreases when exposed to US waves for 5 and 10 minutes.

Conclusions

It concluded that there is a lack response within hypertension patients which is lead to poor activation of the platelet when exposed to ultrasound. furthermore ultrasound considered as a kind of stressor may has a negative effect on platelets by increasing of mean pletelet volume (MPV) which is make to be highly in healthy cases Unlike the response of hypertension patiens.

Conflict of Interest: (Nil – There Are "No Conflict of Interest").

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Ethical Clearance: Committee members are approved to perform a study about:

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