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RESEARCH ARTICLE

The discrepancy in blood pressure values between both arms in individuals with hypertension and other cardiovascular defects.

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Abstract

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Usually differences in blood pressure between arms are associated with vascular disease, hypertension and increased mortality. Also the hypertension is one of the major causes of premature morbidity and mortality throughout the developed and developing worlds. We explored these relations in current study. Our study involved 59 case (43 male and 16 female) with age between (17-35) years old, age mean \pm SD (23.6949 ± 4.94192), were diagnosed as follows (41 with hypertension, 16 with hypertension and left ventricle hypertrophy, 1 with hypertension and bicuspid aortic valve and aortic coarctation, and 1 with hypertension and aortic coarctation), also the radiofemoral delay was positive in cases with aortic coarctation. The results shown statically significance among sex group ($P=0.004$). Also the statistical interpretation shown strong difference in the BP measurements between both hand ($P = 0.000$). On the other hand the results showed the frequencies of other cardiac and valvular problem that recorded by Echo. Study (41 case was normal, 17 case presented with LVH and 1 case found with bicuspid aortic valve) at significance ($P = 0.000$). According to MRA study of aorta and its branches, our finding was (47 case was normal and 2 case was presented with aortic coarctation) and the P value was ($P = 0.000$). In conclusions, differences of more than 10 mmHg in blood pressure recorded between arms are frequent in hypertensive individuals, also the association of discrepancy in blood pressure and other cardiovascular disease (aortic coarctation, bicuspid aortic valve and LVH) wasn't seemed strong evidence in this study.

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Introduction

The difference in blood pressures between arms is associated with peripheral arterial disease, cerebrovascular disease, and increased cardiovascular (Clark et al., 2012b). Also the difference of blood pressure values in both arms can be considered important in the diagnosis of diseases that may involve the aortic arch or upper-extremity arteries and can cause a difference in the numbers obtained. These diseases include: coarctation of the aorta proximal to the left subclavian artery (Ellis and Clagett, 1957). The anatomy of the aorta involving the aortic arch (Hirst, Johns, and Kime, 1958; Levinson, Edmeades, and Griffith, 1950). syphilitic aortitis (Korns and Guinand, 1933), other aortic arch syndromes (Judge et al., 1962), supraaortic stenosis (French and Guntheroth, 1970; Morrow et al., 1959). Actually there was an association between hypertension and difference in blood pressures between both arms. The latest British guidelines for the management of hypertension merely state that BP should initially be measured in both arms as patients may have large differences (>10 mm Hg) between arms. The arm with the higher values should be used for subsequent measurements (Williams et al., 2004). So, the value frequently accepted to be clinically critical and cited at the bedside, is a greater than 10 mm Hg difference in systolic blood pressure of one arm contrasted and the other (Singer and Hollander, 1996). Inability to perceive an interarm discrepancy in blood pressure may erroneously classify the majority of subjects with such a distinction as having controlled hypertension if the lower

reading arm is measured (Clark et al., 2009). This can postpone the diagnosis or confound the treatment of hypertension (Kuwayama et al., 1990). The aim of this study was to notice the discrepancy in a blood pressure in both arm, greater than 10 mm Hg in subjects with hypertension and other cardiovascular diseases.

Materials and methods:-

Population study:-

Our study involved 59 case (43 male and 16 female) with age between (17-35) years old, age mean \pm SD (23.6949 ± 4.94192), were diagnosed as follows (41 with hypertension, 16 with hypertension and left ventricle hypertrophy, 1 with hypertension and bicuspid aortic valve and aortic coarctation, and 1 with hypertension and aortic coarctation), also the radiofemoral delay was positive in cases with aortic coarctation. All cases were enrolled in this study, recruited at Al-zahraa teaching hospital, Wasit, Iraq. The ethics committees of participating universities and university hospitals approved the study, and informed consent was obtained from all participants.

Assessment of Echocardiography:-

An echocardiogram is a type of ultrasound test that uses high-pitched sound waves that are sent through a device called a transducer. The device picks up echoes of the sound waves as they bounce off the different parts of the heart. Echocardiography can help detect cardiomyopathies, such as hypertrophic cardiomyopathy, dilated cardiomyopathy, and many others. All cases has been undergone to Echocardiography study to investigate any cardiac or valvular disease that may be found alternative with hypertension.

Magnetic Resonance Angiogram (MRA):-

A magnetic resonance angiogram (MRA) is a type of magnetic resonance imaging (MRI) scan that uses a magnetic field and pulses of radio wave energy to provide pictures of blood vessels inside the body. MRA can find problems with the blood vessels that may be causing reduced blood flow, both the blood flow and the condition of the blood vessel walls can be seen. The technique was used to investigate the defect of arteries, veins and blood vessels of the heart, during MRA the area of the body being studied is placed inside an MRI machine. Contrast material (intravenous injection) is often used during MRA to make blood vessels show up more clearly.

Statistical analysis of data:-

Statistical analysis of data was done by SPSS package version 17. The sex, blood pressure in different arms, aortic coarctation with discrepancy of blood pressure in both arms, left ventricle hypertrophy with discrepancy of blood pressure in both arms, and bicuspid aortic valve with discrepancy of blood pressure in both arms, were compared using the Chi-squared test (X^2), t-test were used to test the significance of results of quantitative variables. Also Monte Carlo test was done. Odds ratio and 95% confidence interval (95% CIs) were calculated for different studied parameters. The confidence interval (CI) at 95% was used to describe the amount of uncertainty associated with the samples (Greenfield et al., 2008; Szumilas, 2010). The significance of the results was taken at the $P < 0.05$ level of significance.

Results:-

Our results revealed significance difference among sex group according to statistical analysis ($P = 0.004$) as shown in the table 1. On the other hand the statistical interpretation shown strong difference in the BP measurements between both hand ($P = 0.000$) as shown in the table 2. The results showed the frequencies of other cardiac and valvular problem that recorded by Echo. Study (41 case was normal, 17 case presented with LVH and 1 case found with bicuspid aortic valve) at significance ($P = 0.000$) as shown in the table 3. According to MRA study of aorta and its branches, our finding was (47 case was normal and 2 case was presented with aortic coarctation) and the P value was ($P = 0.000$) as shown in the table 3.

Table1:- showed the frequency, percent and Significance among sex.

Sex	Frequency	Percent	Significance	OR (95% CI)
Male	43	72.9	$X^2 = 8.386$ $P = 0.004$	(0.063 - 0.353)
Female	16	27.1		
Total	59	100.0		

X^2 : Chi-Square test

*significant at $P \leq 0.05$

Table 2:- showed the frequency, percent and Significance discrepancy between both arms.

Left arm BP	Frequency	Percent	Right arm BP	Frequency	Percent	Significance	Monte Carlo Sig. (2-sided)		
						P = 0.000	95% Confidence Interval		
175/120	1	1.7	120/60	1	1.7		Sig.	Lower Bound	Upper Bound
160/100	1	1.7	120/70	1	1.7		0.015 ^b	0.013	0.017
165/115	11	18.9	120/80	22	37.3				
165/120	5	8.4	130/70	1	1.7				
165/65	1	1.7	135/70	1	1.7				
165/90	1	1.7	140/70	1	1.7				
170/100	5	8.4	140/80	1	1.7				
170/115	11	18.9	140/90	17	28.9				
175/100	1	1.7	150/85	10	16.9				
175/110	3	5.0	160/100	4	6.7				
180/100	1	1.7							
180/110	3	5.0							
185/100	5	8.4							
185/125	4	6.7							
190/110	4	6.7							
190/80	1	1.7							
195/120	1	1.7							
Total	59	100.0	Total	59	100.0				

*significant at $P \leq 0.05$ **Table 3:-** showed the frequency, percent and Significance between Echo. Finding (normal, LVH and bicuspid aortic valve) and MRI of aorta and its branches and relation with discrepancy between both arms.

Echo. Finding	Frequency	Percent	Significance	MRA of aorta and its branches	Frequency	Percent	Significance
Normal	41	69.5	P = 0.000	Normal	57	96.6	P = 0.000
LVH	17	28.8		Aortic coarctation	2	3.4	
Bicuspid aortic valve	1	1.7		Total	59	100	
Total	59	100.0					

*significant at $P \leq 0.05$ **Discussion:-**

Many recent studies discussed the difference in blood pressure between two arms (Clark, 2015; Clark et al., 2006; Kleefstra et al., 2007). Our study approved there is clear difference between both arms in PB according to statistical analysis, and the values of right hand greater than left hand at least (>10 mm Hg) in hypertension patients. One of study was reported on the prognostic significance of interarm blood pressure difference in a cohort of renal and general medical clinic subjects. They cite studies in asserting that the right arm blood pressure consistently reads higher than the left (Agarwal, Bunaye, and Bekele, 2008). Banks, M.J et al., proved that the presence of a difference between arm measurements has been implicated in a delayed diagnosis of hypertension (Banks et al., 2001), and is associated with a higher prevalence of poor control in hypertension (Aboyans et al., 2007). Also the prevalence in interarm blood pressure difference are higher in the presence of hypertension had been mentioned previously (Clark et al., 2006). The Peripheral arterial disease, a recognized risk factor for future cardiovascular events and mortality, has been assumed to be the pathological basis for an interarm difference in blood pressure (Clark, 2001; Clark et al., 2006). The differences observed may result from more diffuse stiffening in the arteries since structural changes in large arteries as a result of hypertension begin early in the course of the condition and are insidious, whereas symptomatic cardiovascular and peripheral vascular disease are late sequelae of a process of gradual arterial stiffening as a result of damage to the elastic fibers under sustained elevated blood pressure (Williams, 2007). Other studies noticed the differences in systolic blood pressure between arms can predict an increased risk of cardiovascular events and all-cause mortality in people with hypertension (Clark et al., 2012a; Weinberg et al.,

2014). Also the differences of more than 10 mm Hg in indirect systolic blood pressure recordings between arms are frequent in asymptomatic hypertensive individuals and do not per se indicate any pathologic condition. In the right clinical situation, differences that are noted should be repeated and should be added to the total clinical picture when used to determine whether a pathologic condition is present. Assuming no significant aortic or subclavian disease in the population tested, the specificity of the bilateral blood pressure test was 82% (Pesola et al., 2002). The evaluation of blood pressure in both arms is considered important in the diagnosis of conditions that may involve the aortic arch or upper-extremity arteries and can cause a difference in the numbers obtained. One of these conditions include coarctation of the aorta proximal to the left subclavian artery (Ellis and Clagett, 1957). As a cardiovascular problems, the aortic coarctation, bicuspid aortic valve and LVH was reported in our study but actually wasn't significantly associated with discrepancy of blood pressure between two arms in hypertensive patients.

Conclusion:-

our study suggest there is a strong evidence between the discrepancy in blood pressure between the two arms and hypertensive, also the association of discrepancy in blood pressure and other cardiovascular disease (aortic coarctation, bicuspid aortic valve and LVH) wasn't strongly clarify in our findings.

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