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POSTURAL CHANGES IN BLOOD PRESSURE ASSOCIATED WITH AGEING

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ABSTRACT

The present study reveals to determine the patterns of orthostatic blood pressure (OBP) changes, symptoms and clinical factors in different aged groups. Sixty subjects of different aged group between 20 and 90 were used in this study. Among these groups, different measurements of BP were done in lying as well as standing position at two time intervals (1min, 3min) to check their orthostatic hypotension (OH). The Results showed that OH significantly increased in the age group 71.1 and moderate in 39.8 and no changes occurred in 20.55. The symptoms of head ache, blurred vision, falling and light headedness as well as blood hemoglobin levels were independent of OH in all aged groups. Based on the nutritional status, Body Mass Index was measured in these subjects and identified as 72% well nourished; 4% under-nourished and 24% overweight. The systolic OH ($P<0.01$) was more common among the elderly subject than diastolic OH ($P>0.05$). Also prevalence was similar in either gender of elderly group. Based on the present study, we conclude that OH incidence increases with increase in age and symptoms are independent of physical recording.

Key words : Orthostatic Blood Pressure, Ageing, Orthostatic Hypotension, Symptoms.

INTRODUCTION

Orthostatic blood pressure (OBP) is a measure of cardiovascular reactivity reflecting autonomic function which is indicated by baroreceptor reflex. The causes of rapid shifting blood from the thoracic and abdominal cavities to the lower extremities of body are due to movement from a supine or sitting position to standing which reduces venous return and stroke volume. Under normal conditions, this stimulates baroreceptors to activate the sympathetic nervous system, leading to vasoconstriction and increased heart rate so as to maintain a stable blood pressure as parasympathetic nerve signals to the heart are withdrawn, thus causing short-term blood pressure changes (Elissa Wilker et al. 2009).

Orthostatic hypotension (OH) was defined by the American Autonomic Society and the American Academy of Neurology as a decrease of at least 20mm Hg in systolic blood pressure (SBP) or 10mm Hg in diastolic blood pressure (DBP) within three minutes of standing (John G. Bradley MD et al. 2003; Simona Maule et al. 2007).

OH is an important cause of recurrent falls in the elderly and is associated with increased morbidity and mortality (Räihä I et al. 1995; Masaki KH et al. 1998). The prevalence of OH in elderly is about 6% to 30 % (Mader SL et al. 1987;

Alli C et al. 1992; Rutan GH et al. 1992; Räihä I et al. 1995).This phenomenon has been attributed to age associated systolic hypertension (Harris T et al. 1991; Rutan GH et al. 1992; Mukai S and Lipsitz LA, 2002). Older people differ from the young or middle aged adults with the same disease in many ways, one of which is the frequent occurrence of co morbidities and of subclinical disease. A second way in which older adults differ from younger adults is the greater likelihood that their diseases present with nonspecific symptoms and signs (Alagiakrishnan K, 2007).

Hemodynamic homeostasis becomes less effective with aging and is associated with a decreased ability to regulate blood pressure. OH is a common clinical disorder among the older population without symptoms (Gupta V and Lipsitz LA, 2007). Blood pressure is regulated by activity in autonomic nervous system. Due to age related physiologic changes, the response of the sympathetic system is usually decreased. Hence elder people tend to be more vulnerable to orthostatic stress than the younger ones. Also such elder ones having some associated diseases like hypertension, diabetes mellitus, and low blood volume become further weaker (Low PA, 2008).

In the present study, we examined the effect of standing posture on blood pressure Viz, systolic and diastolic blood pressure and heart rate. Blood hemoglobin percentage in different age groups was recorded.

METHODOLOGY

STUDY POPULATION

The subjects were carefully selected in the ages between 20 and 90 years of either gender from Johor Bahru urban areas in Malaysia. All subjects belonging to mixed socioeconomic status were taken and subjects were non smokers and rest from any cardio respiratory diseases. Questionnaires evaluated smoking habits, medication use and history of past illness. The Institutional Ethics Committee approved the study protocol.

EXPERIMENTAL DESIGN

The Orthostatic Test was conducted on apparently healthy subjects. Readings were taken in supine posture followed by standing posture. The test was performed between 6.30 AM and 11.00 AM before breakfast. In the experiment, a total of 60 healthy subjects of different aged samples were used. The samples were divided into three groups of 20 each.

Group I: The subjects of 20 years and above of either sex

Group II: The subjects of 40 years and above of either sex

Group III: The subjects of 60 years and above of either sex

The participants were carried out the physical examinations including measurement of height and weight, and body mass index (BMI) was calculated as weight (in kilograms) divided by height (in square meters) (Quetelet's index). Blood levels of haemoglobin were estimated by using the cyanmethaemoglobin method described by Drabkin DL and Austin JM. (1932).

MEASUREMENTS

Blood pressure was measured in right arm using a mercury Sphygmomanometer and Stethoscope after five minutes rest in the supine position with the right arm supported at heart level, resting on the examination table with the elbow extended. The higher of the two similar BP readings was taken for analysis.

The subject was asked to stand up quickly, and the blood pressure was measured by the same examiner at 1 minute and 3 minutes of unsupported standing respectively. The average of two readings of systolic blood pressure (SBP) and the two readings of diastolic blood pressure (DBP) were taken to determine the blood pressure of the study subject. The two readings were differed by more than 10 mm Hg, in such case, a third reading was obtained and the three measurements were averaged.

Previous studies have noted that most hemodynamic changes related to the assumption of standing posture occur within the 1min of standing (Akselrod S et al., 1997; Elissa Wilker et al. 2009). Postural changes in SBP and DBP were calculated as mean lying minus standing for SBP (ΔSBP) and DBP (ΔDBP). In standing posture, the accurate BP was measured by keeping the person's hand in extended position with support at heart level (Adiyaman A et al. 1999). Heart rate (HR) was recorded by counting the pulse rate by palpation of the radial artery for one minute.

STATISTICAL ANALYSIS

All data are expressed as mean ± standard deviation. A two tail Probability value ($p<0.05$) considered as significant.

RESULTS

The symptoms of head ache, blurred vision, falling and light headedness as well as blood hemoglobin levels were independent of OH in all three groups shown in Table I. Based on the nutritional status, Body Mass Index were measured in these subjects and identified as 72% well nourished; 4% under-nourished and 24% overweight. OH significantly increased in the group III, less prevalent in group II and no changes occur in group I.

TABLE 1: ***Clinical characteristics of different age groups, their symptoms and signs***

Group	Number	Symptoms				OH recorded	Hb (g/dl)	BMI (Wt/Ht^2)
		Head ache	Blurred vision	Falling	Light Headed			
I	20	2	0	0	0	0	14.26 ± 1.28	23.87 ± 2.35
II	20	2	1	0	1	2*	13.34± 1.89	24.62 ± 3.28
III	20	6	4	4	8	2+4*	13.12 ± 2.07	21.45 ± 1.05

* With previous history of Hypertension with Medication.
Values are given in Mean ± SD for three groups.

Table II shows the mean BP values measured in different age groups. The systolic OH ($P<0.01$) was more common among the elderly subjects than diastolic OH ($P>0.05$). Heart rate in supine position compared with standing position illustrated in Figure I. Heart rate was higher in standing position in all three groups. Based on our results, OH incidence increases with increase in age and symptoms are independent of physical recording.

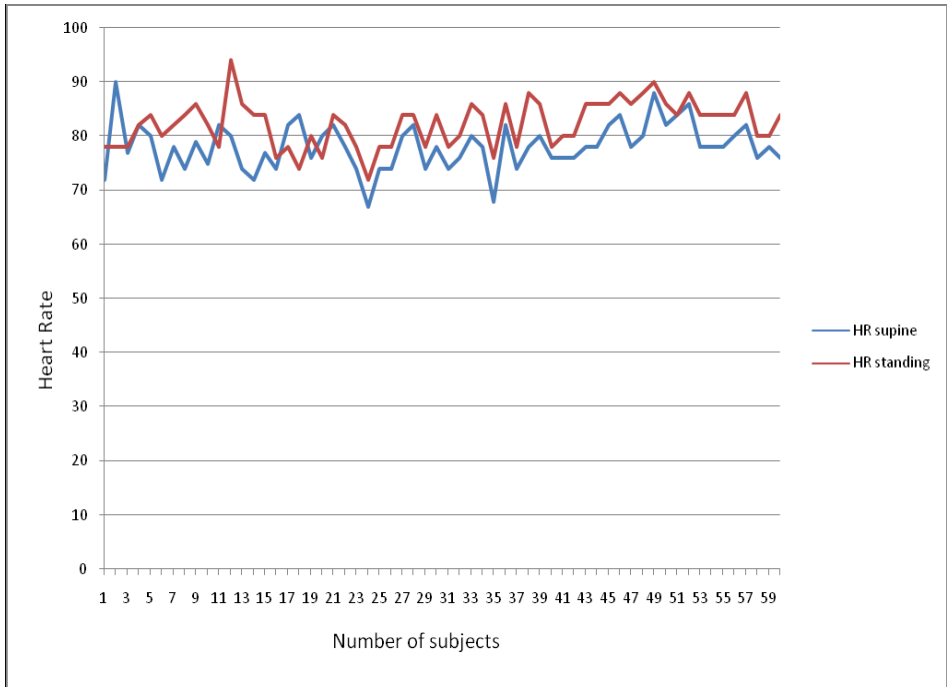

FIGURE 1: ***Heart rate (HR) in supine position compared with standing position***

TABLE 2: ***BP measurement in different age groups***

Groups	Mean of Age	During Lying Down Position		During Standing Position			
		SBP mm Hg	DBP mm Hg	SBP at 1 Min	DBP at 1 Min	SBP at 3 Min	DBP at 3 Min
I	20.55 ± 2.37	117.7± 6.63	78 ±4.81	115.5± 7.40*	79.3± 5.70**	117.6 ± 6.64*	78.4 ± 4.93**
II	39.8±5.40	126.4±7.72	84.9 ±6.21	119.4±11.66*	89.7 ± 7.12**	123.9 ± 8.69*	85.9 ± 7.72**
III	71.1±9.70	125.2±15.33	79 ±9.94	110.4±11.23*	78 ± 13.10**	114 ± 11.66*	76.2 ±10.64**

*Values are statistically significant at $P < 0.05$; **Values are statistically not significant at $P < 0.05$; Values are given in Mean ± SD for three groups.

DISCUSSION

Orthostatic hypotension is a risk factor for cardiovascular diseases and all-cause of mortality (Luukinen H et al. 1999; Shin C et al. 2004). The prevalence of OH among elderly persons has significantly increased in developed countries during the past decade (Shin C et al. 2004).

Gupta D and Nair MD (2004) and Rutan GH et al (1992) found that OH is a frequently encountered problem affecting about 30 % of the population more than 60 years. . Luukinen H et al (1999) observed that systolic OH was associated with low BMI. Similar observations were made in the present study. OH in elderly subjects was not associated with anti hypertensive medication use (Ooi WL et al. 1997). But In the present study OH was associated with anti hypertensive medication use in Group II and Group III (Low PA, 2008).

Orthostatic symptoms as well as Blood Hb levels were independent of OH in all aged groups. Past history of Hypertension and usage of medications were the most common underlying conditions. Two subjects of Group II were already suffering from hypertension showed fall in SBP after 1 minute, but no difference was observed after 3 minutes of standing (Weiss A et al. 2002; Artur Fedorowski et al. 2010). Four elderly subjects of Group III were on anti hypertensive medications showed similar fall in SBP (Harris T et al. 1991). Earlier study on elderly showed medications such as antihypertensive and diuretics can cause or aggravate OH (Hajjar I, 2005). Two other elderly subjects showed a fall in SBP had no history of hypertension. Neurological diseases such as diabetic neuropathy, Parkinson's disease, multiple system atrophy and the autonomic neuropathies further increase the likelihood of OH (Low PA, 2008).The impaired orthostatic homeostasis was associated with age, history of hypertension and antihypertensive drug usage (Low PA, 2008; Artur Fedorowski et al. 2010).Group I subjects were non diabetic, non hypertensive, non alcoholic and non smokers and their mean age was less. OH was not present in any of the subjects in this group.

CONCLUSION

The results indicate that underlying disease process and the medications used for treatment are major causes for orthostatic hypotension in the elderly and middle aged groups. Further studies are required to confirm these findings especially using a large group of geriatric healthy subjects to represent the Malaysian population.

2a. in supine position

2b. in standing position

Fig. 2 ***Photographs show the measurement of blood Pressure***

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