ORIGINAL ARTICLE

Frequency of Aortic Regurgitation in Patients with Hypertension presenting in a Teaching Hospital

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ABSTRACT

Background: It is usually presumed that hypertension (HTN) leads to aortic root expansion following aortic regurgitation (AR) but recent studies of M-mode and pathological echocardiography have not established any association between hypertension and aortic root enlargement when age is considered.
AIM: To assess the frequency of aortic regurgitation in hypertensive patients presenting in a tertiary care hospital for regular check-up
Method: This was a descriptive, Cross sectional study and it was completed in 6 months. Reports of 150 patients fulfilling selection criteria were selected from medical record section of hospital, Department of Medicine, Cavan General Hospital, Ireland. Demographic details were obtained. Then reports of echocardiography were assessed. The diagnosis was interpreted as following; if yellow, red, or mosaic signals were observed initiating from the aortic valve and disseminating into left ventricle (LV) during diastole on echocardiography, then AR was labeled. All procedures were noted on a proforma. The data was entered and analyzed on SPSS version 21.
Results: In this study, it was found that about 16 (10.67%) of the hypertensive patients were diagnosed with AR. Frequency of AR was found to be higher in older patients. Among female patients its frequency was found higher in over-weight patients. On the other hand, around 50% diabetic patients (8/16) exhibited positive findings for AR and patients whose duration of hypertension was in between 11-20 years among them the frequency of AR was highest (41.8%). However all these factors did not show any statistically significant association with AR.
Conclusion: It is concluded that this study showed low frequency (10.67%) of AR in patients presenting with hypertension. In routine practice, AR among hypertensive patients is ignorable. Despite of AR low frequency, hypertensive patients should be regularly screened for AR so that they may be prevented from development of AR and its complication.
Keywords: Ortic Regurgitation, Hypertension, Diabetes

INTRODUCTION

Hypertension (HTN/HT), usually termed as high blood pressure (BP), is a medical condition in which pressure in the arteries is consistently raised over a period of time. Initially, there are no prominent sign and symptoms of high BP however long term uncontrolled high BP is a major risk factor for heart failure, coronary artery disease, peripheral vascular disease, stroke, retinopathy and nephropathy[1]. Therefore, it becomes an obligatory duty of health care professionals to diagnose and treat hypertensive patients as early as possible and also educate them to spend a healthy lifestyle to decrease the hypertension disease burden in the overall population[2].

The prevalence of HTN in Irish population was reported to be 63.7%[3]. Approximately 75 million adults in the United States (US) are affected by hypertension according to the reports of American Heart Association (AHA). According to National Health and Nutrition Examination Survey (NHANES) of 2005- 2006, 29% of US adults, eighteen years of age and older, were hypertensive and 7% of those hypertensive patients had never come to know that they had hypertension[4]. Overall, it has been estimated that 20% of the world's adults are hypertensive and prevalence of HTN vividly increases in people older than 60 years[5].

The classification of Blood Pressure (BP) expressed in mmHg, based on recommendations of the JNC 7, for adults aged eighteen years or older people, is as follows[2]:

1. Normal: Systolic Blood Pressure (SBP)less than 120 mm Hg, diastolic Blood Pressure (DBP) less than 80 mm Hg
2. Pre-hypertension: SBP 120-139 mm Hg, DBP 80-89 mm Hg
3. Stage 1: SBP 140-159 mm Hg, DBP 90-99 mm Hg
4. Stage 2: SBP 160 mm Hg or greater, SBP 100 mm Hg or greater

This classification is based on the average of two or more readings of blood pressure taken at different visits after primary screening. Normal Blood Pressure is less than 120/80 mm Hg with respect to cardiovascular risk. Abnormally low BP should be measured and evaluated for any clinical significance[2,6].

Pre-hypertension patients are at great risk to develop hypertension with time so lifestyle modifications may be the main preventive strategies[7]. HTN may also be classified as either essential HTN or secondary HTN. When there is no definite cause of HTN known then it's labeled as Primary (essential) HTN. Approximately, 90-95% of hypertensive adults have primary hypertension, whereas 5-10% of the cases are categorized as having secondary hypertension with some other abnormality, such as primary hyperaldosteronism. Secondary hypertension accounts for 20% of resistant hypertension (BP remains more than

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140/90 mm Hg despite taking regular medicines from three or more different classes of antihypertensive drugs)[8].

Atrial regurgitation (AR) is abnormal diastolic backflow of blood from the aorta into the Left Ventricle (LV). AR occurs due to incompetent aortic valve or any defect of the valvular apparatus (e.g., annulus of the aorta, leaflets)[9]. Valvular abnormalities may be due to congenital or acquired causes[9] such as infective endocarditis, rheumatic fever, collagen vascular diseases and degenerative aortic valve disease. AR is commonly found in the echocardiograms. Some of earlier studies depicted that there is an association of hypertension with aortic root enlargement and AR while other echocardiographic and pathological reports remained unsuccessful to show such an association[10]. Hypertension and AR often coexist but the specific impacts of AR with hypertension on the LV are still unknown[11].

AR may occur acutely and presents as heart failure or it may proceed to chronic disease. Initially, rheumatic heart disease was considered as most common cause of chronic AR but presently bacterial endocarditis is considered the most common cause of AR. Dilation of the ascending aorta (e.g., aortoannular ectasia, aortic root disease) is the cause of AR in developed countries [12, 13].Although, prevalence of AR globally is not well known, however, the estimated prevalence of underlying conditions/ abnormalities has been reported in different studies. For instance, prevalence of rheumatic heart disease remains higher in many North African, Middle Eastern and Asian countries[14]. Despite variable international prevalence of the predisposing diseases such as rheumatic heart disease, the prevalence of AR seems to be same across different ethnic populations in the US[14].

Frequency of AR is more in males than in females. According to one of Framingham studies, AR was present in 13% of males and 8.5% of females in a selected cohort of people. The higher prevalence of AR in males may reflect that certain underlying causes are present more in males than in females[17].

Aortic valve closure defects may result from diseases of aorta, trauma orintrinsic disease of the aortic valve cusps. Incompetent aortic valve causes diastolic reflux back into LV and results into volume overload. Increased pulse pressure in created due to low diastolic aortic pressure and increased systolic stroke volume. Clinically, AR sign and symptoms appear due to abnormal to and flow of blood, through aortic valve, which leads to increase in stroke volume. The intensity of AR is dependent on several diastolic factors like pressure gradient between the aorta and left ventricle during diastole, diastolic valve area and the duration of diastole[18].

Acute severe AR causes blood pooling during diastole and left ventricle fails to dilate accordingly due to sudden volume overload. Consequently, end diastolic pressure goes on increasing abruptly in left ventricle which results into an increase in pulmonary venous pressure and abnormal coronary blood flow. Patients develops dyspnea and pulmonary edema due to increase in pressure in pulmonary circuit and in more severe cases, heart failure may occur with or without cardiogenic shock[18]. Infective endocarditis[19], chest trauma, acute ascending aortic dissection (type A)[20] are the major causes of acute AR development. AR can also occur as a complication of prosthetic valve malfunctioning[20]orLV assist device implantation [21].Severe acute AR usually presents with sudden, severe breathlessness, ischemic chest pain and rapidly developing heart failure[18].

AR chronic patients may remain asymptomatic over a period of several years even after doing some exercise with the development of compensatory tachycardia for maintenance of enormous forward stroke volume and reduced diastolic filling time. However, LV malfunctioning starts developing due to chronic volume overload over a period of time. Substantial worsening of LV function may be started before appearance of symptoms of AR in up to 25% of patients, emphasizing the significance of periodic echocardiographic surveillance[22].

Any heart valve problem puts patient at risk of an infection of the heart's inner lining (endocarditis). Defective aortic valve is more vulnerable to infections than a healthy valve. When aortic valve leakiness is mild, AR may never be a serious issue to health. But when it's severe, AR may lead to heart failure. In heart failure condition, hearts fails to pump adequate quantity of blood to fulfill body's needs[23].

The rationale of this study was to assess the frequency of aortic regurgitation in hypertensive patients, presenting in a tertiary care hospital for regular check-up, and association of AR with gender, age, body mass index (BMI), diabetes mellitus, and duration of hypertension in the selected group of hypertensive patients.

MATERIAL AND METHODS

It was a cross-sectional descriptive study conducted on 150 hypertensive patients at Department of Medicine, Cavan General Hospital, Ireland. Our inclusion criteria was to get; medical record of hypertensive patients between age of 40-80 years, of either gender presenting for routine check-up or follow up and exclusion criteria was; individuals with history of ischemic heart disease and/or acute coronary syndrome (medical record) and patients with previous CABG or PCI (on medical record).

Reports of150 patients fulfilling the selection criteria were selected from medical record section of the hospital, Department of Medicine, Cavan General Hospital, Ireland. Confidentiality of the data was ensured and proper consent was taken before data collection. The demographic details (name, age, gender, BP and BMI) were obtained from each medical report. Then reports of echocardiography (ECG) were further assessed and interpretation was inferred. Diagnosis was established as following; if red, yellow or mosaic signals (blue in parasternal long axis) were seen originating from the aortic valve and spreading into the left ventricle during diastole on echocardiography, then AR was labeled (as per operational definition). All procedures were written and noted on a prescribed proforma.

The data was arranged, entered and analyzed by IBM SPSS 21.0 version. All the quantitative variables like BP, age and BMI were presented as mean and standard deviation (SD). All the qualitative variables like gender, duration of hypertension, history of DM and AR were given in the form of frequencies and percentages. Then the data was stratified for gender, age, BMI, history of DM and duration of hypertension. Chi-square test was applied to

compare the stratified groups.P-value≤0.05 was considered as statistically significant.

RESULTS

Total of 150 patients were selected and their medical record was obtained to conduct the study. The mean age of patients was 59.56±11.66 years with the range of 40-80 years. Mean BMI of patients was 26.29±4.15. Minimum and maximum BMI of patients was 20.10 and 34.97 respectively. Mean duration of hypertension of patients was 12.38±7.75 (Fig.1).

There were 84(56%) male and 66(44%) female patients included in the study. There were 78(52%) patients who were diabetic.AR was seen in 16(10.67%) of the hypertensive patients (Table 1).

Highest frequency of AR was seen in patients who were >60 years followed by patients who were 51-60 years and the lowest frequency was seen in patients who were 40-50 years of age. No statistically significant association was seen between age and occurrence of AR (Table 2) i.e., p-value=0.111.Frequency of AR was higher in female patients but gender was not significantly associated with AR. i.e. Male: 37.5%& Female: 62.5%, p-value=0.115. No statistically significant association was seen between BMI of patients and occurrence of AR. i.e. p-value=0.399. Among diabetic patients 8(50%) of the patients had AR. But diabetic status of patients was not significantly associated with AR. i.e. p-value=0.865. The highest frequency of AR was seen in patients whose duration of hypertension was in between 11-20. While patients with duration 1-10 and >20. But no statistically significant association was seen between duration of hypertension and occurrence of AR. i.e. p-value=0.376 (Table 2).

Fig. 1: Mean+SD of age, GMI and duration of hypertension

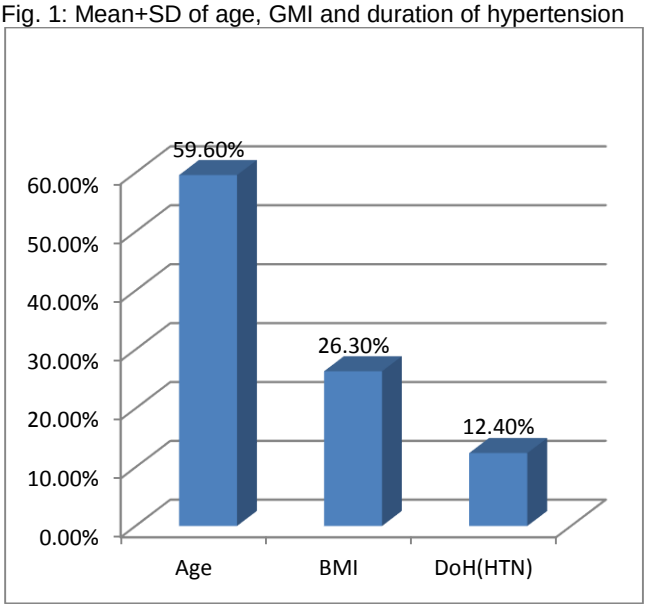

Table 1:

Gender		**Diabetic status**		**AR in hypertensive patients**	
Male	Female	YES	NO	YES	NO
84 (56 %)	66 (44 %)	78 (52 %)	72 (48 %)	16 (10.67%)	9.33 %)

Table 2: Association of age, gender, BMI, duration of hypertension and diabetes mellitus with AR

		AR		Total	Chi square value	P value
		Present	**Absent**			
Age (years)	40-50	1(6.3%)	42(31.3%)	43	4.403	0.111
	51-60	4(25%)	25(18.7%)	29		
	>60	11(68.8%)	67(50%)	78		
Gender	Male	6(37.5%)	78(58.2%)	84	2.488	0.115
	Female	10(62.5%)	56(41.8%)	66		
BMI	Normal	2(12.5%)	38(28.4%)	40	1.838	0.399
	Over Weight	8(50%)	55(41%)	63		
	Obese	6(37.5%)	41(30.6%)	47		
Diabetes mellitus	Yes	8(50%)	70(52.2%)	78	0.029	0.865
	No	8(50%)	64(47.8%)	72		
Duration of HTN	1-10	5(31.3%)	56(41.8%)	61	1.954	0.365
	11-20	6(37.5%)	55(41%)	61		
	>20	5(31.3%)	23(17.2%)	28		

DISCUSSION

Although it was believed that on the basis of earlier case reports and pathological series that HTN might directly predispose to AR because of enlargement of aortic root but its contradictory with recent pathological and M-mode echocardiographic studies in which no association has been found between HTN and aortic root size when the confounder “age” is considered.

Thus, diameter of aortic root is directly related to age, and cystic medial necrosis may occur due to this senescence process. In contrast, other M-mode echocardiographic studies have shown substantial relationship of aortic root diameter to systolic and diastolic pressures[24]. Likewise, severe AR caused by idiopathic aortic root dilatation is linked with antecedent HTN. Differences in the present literature about the outcome of HTN on aortic root expansion may partially be due to methodological shortcomings in the accuracy and reproducibility of aortic and BP measurements. Although, M-mode echocardiography is a reliable tool for the assessment of aortic root diameter, it may result in systematic

underestimation of aortic diameter at the sinuses of Valsalva due to cyclic cardiac translational changes and does not permit extensive assessment of the entire aortic root, including the supra-aortic ridge, which serves as the site of commissural insertion[24].

In this study it was found out that 16(10.67%) of the hypertensive patients were diagnosed with AR. Frequency of AR was found to be higher in older patients. Among female patients its frequency was higher as that of female patients, over weight patients had the highest frequency for AR, only 8/16 diabetic patients exhibit positive findings for AR and patients whose duration of hypertension was in between 11-20 years among them frequency of AR was highest. However all these factors did not show any statistically significant association with AR.

One study has showed that AR was found in 6.4% of the hypertensive subjects[25]. Another study showed that AR was found in 6.6% of the hypertensive subjects[26]. Frequency of AR in above mentioned studies was lower as that of frequency for AR in this study. But in this study frequency of AR was not that much higher as that of above reported in above mentioned studies. Ghassan Abbod Ahmed and his colleagues in their study showed that 5.5% of the healthy individuals with normal BP and 7.3% of the hypertensive individuals were diagnosed with AR. AR was mild in 2 and moderate in 4 normotensive subjects, and mild in 3 and moderate in 5 hypertensive subjects[24].A negative relationship, albeit insignificant, was observed between the degree of AR and body mass index in the Framingham Heart Study. Obese people may have some negatively affect onquality of echocardiographic study, possibly resulting in underestimation of aortic root diameter and AR[15]. However, in this study, it was observed that among over weight patients frequency of AR was highest followed by the obese patients. In the Strong Heart Study, gender was not related to AR[27]. In the Framingham Heart Study, the Odd Ratio(OR) for AR associated with male gender was 0.6, adjusted for age, body mass index and hypertension. Further research and investigations are required on the relation of gender to heart valves disease[15]. In this study no statistically significant association was seen between AR with age, gender and body mass index of patients. Vittorio Palmieri findings propose possible advantages of BP control to prevent aortic root enlargement in HTN. However, the slightly greater sinuses of Valsalva diameter in participants with uncontrolled versus controlled hypertension did not yield more AR in the former group[28].

CONCLUSION

In routine practice, AR is commonly observed in hypertensive patients and it's a myth that AR is associated with hypertension but frequency of AR among hypertensive patients remained very low in this study which is according to the other similar studies. There was no strong association of AR with age, gender, BMI and duration of hypertension (statistically not significant). Despite of low frequency of AR in hypertensive patients, these patients should be regularly screened for AR so that they may be prevented from development of AR and its complications.

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