

A Cross-Sectional Observational Study on Assessment of Aortic Elasticity Indices as a Predictor of Severity of Coronary Artery Disease in Patients with and without Hypertension

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ABSTRACT

BACKGROUND & JUSTIFICATION: Coronary artery disease (CAD) is the most typical cardiac condition. Diabetes mellitus, systemic hypertension, dyslipidemia, hypothyroidism, stress, alcohol use, and smoking are the primary risk factors for coronary artery disease. The narrowing or blockage of your coronary arteries is known as coronary artery disease. Breathlessness, chest pain, or even a heart attack may result from this. A continuously elevated pressure in the arteries is called hypertension, sometimes referred to as high or rising blood pressure. Aortic stiffness (AoS), a measure of blood vessel wall flexibility, significantly influences CAD prognosis and reflects subclinical disease. Echocardiography, with its excellent sensitivity and specificity, is a reliable method for detecting CAD and assessing disease severity. This study aims to assess aortic elasticity index in hypertensive and non-hypertensive patients with CAD.

METHODS: A prospective observational study was done in 200 CAD patients who got admitted in ICU and inpatients ward at Chettinad hospital, Kelambakkam. Upon admissions, Aorta measurements were collected from the patients. Aortic Elasticity parameters such as Aortic Systolic diameter and Diastolic diameters were noted and Aortic Elasticity index was calculated.

RESULT: According to this cross-sectional study 200 patients were included in which 100 were patients without hypertension and 100 were patients with hypertension. In cross sectional study of severity of CAD, low risk category showed 78 normotensive patients and 24 were hypertensive patients. High risk category showed 76 hypertensive patients and 22 were normotensive patients.

CONCLUSION: This study found that hypertensive patients (76) had a higher risk of severe coronary artery disease compared to normotensive patients (22). The aortic elasticity index correlated with increased severity of CAD in hypertensive patients, indicating a higher prevalence of CAD in this group.

KEYWORDS: Coronary artery disease, Aortic stiffness, Hypertension, Aortic elasticity index, Aortic strain

INTRODUCTION

In both developing and developed countries, cardiovascular disease (CVD) is now recognized as a main cause of illness and death. According to a current report from the World Health Organization, emerging

countries account for the majority of cardiovascular deaths. Because of sedentary lifestyles and poor eating habits, hypertension is on the rise in emerging nations.

The aortic strain plays an important role in assessment of the aorta diameter in systole and diastole simply by m-mode. This study includes the hypertensive patients and normotensive patients and comparing the aortic elasticity index by the aortic strain (1). The severity of CAD and Aortic elasticity measurements have a strong positive connection in several studies. CAG is used to evaluate the severity of coronary artery disease (2).

METHODS AND MATERIALS:

STUDY DESIGN: The prospective observational study was performed in the department of cardiology at Chettinad hospital and research institute, Kelambakkam, Chengalpattu.

In our study 200 patients presenting at the hospital with and without hypertension were studied according to protocol given to proforma. In which Group I included those without hypertension, Group II included patients with Hypertension.

SAMPLE SIZE: 200 Patients

SUBJECT SELECTION:

INCLUSION CRITERIA: Diabetes mellitus, Systemic Hypertension, Dyslipidemia, patient with family history of CAD, hypothyroidism

EXCLUSIVE CRITERIA:

Patient who are having acute coronary syndrome and other heart related problems; such as valvular heart disease, Age < 18 years , Pregnancy, Psychiatry Patients

Subjects are taken based on the Inclusion and Exclusion criteria.

STUDY PROCEDURE:

The current study was a prospective observational study conducted in the department of cardiology in CSSH. By using 2-dimensional conventional echocardiography in Philips 50C affinity machine, by using the standard echocardiography images PLAX, PSAX, A4C, A2C and Subcostal windows.

M-MODE:

M-mode is defined as time motion display of the ultrasound wave along a chosen ultrasound line. It provides a mono dimensional view of the heart. All of the reflectors along this line are displayed along the time axis.

Aortic Elasticity Index:

- The Aorta contains high proportion of elastin fibres.
- Aortic Elasticity was measured by various methods such as AD, SI and Elastic modulus, Aortic Strain. Of these, Aortic strain is a direct measure of Aortic elastic property which shows better predictivity for CAD severity (3).

Aortic Strain:

Aortic Strain is calculated by using the simple m-mode and by measuring the systolic and diastolic diameter of the aorta. It is calculated by,

Aortic strain (%) = [(Aortic systolic diameter – diastolic diameter) × 100] / Aortic diastolic diameter.

- Significantly higher aortic systolic and diastolic diameters with lower diameter difference were present among patients with significant CAD (4).

RESULT:

TABLE 5.1 DIVISIONS

DIVISIONS	NO OF PATIENTS
HYPERTENSION PATIENTS	100 (50%)
NORMOTENSIVE PATIENTS	100 (50%)

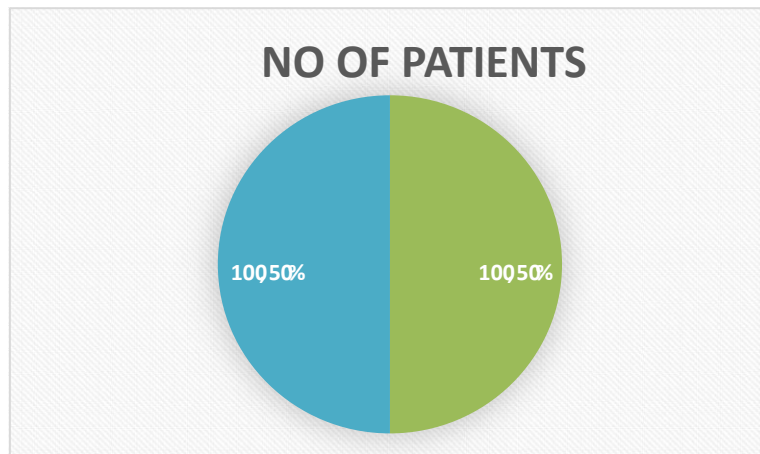


Figure 5.1 Represents Division Categories

TABLE 5.2 THE DISTRIBUTION OF AGE GROUPS

DEMOGRAPHIC AGE RANGE	NO OF PATIENTS
25 TO 35	19
36 TO 45	27
46 TO 55	34
56 TO 65	40
66 TO 75	53
76 TO 85	27

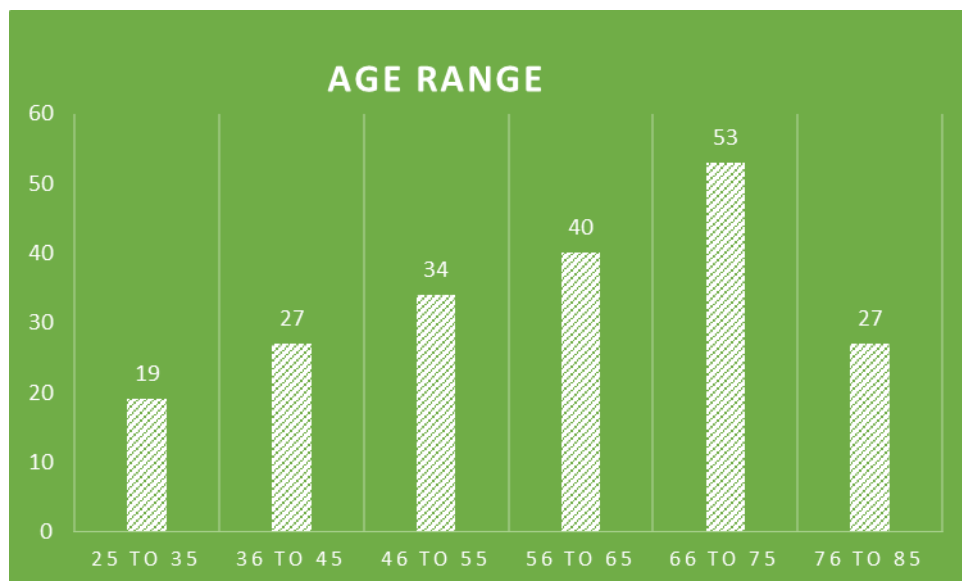


FIGURE 5.2 : AGE GROUPS

TABLE 5.3 DIAGNOSTIC CRITERIA

DIAGNOSIS	NUMBER OF PATIENTS
STABLE ANGINA	20 (10%)
UNSTABLE ANGINA	60 (30%)
STEMI	77 (38%)
NSTEMI	43 (22%)

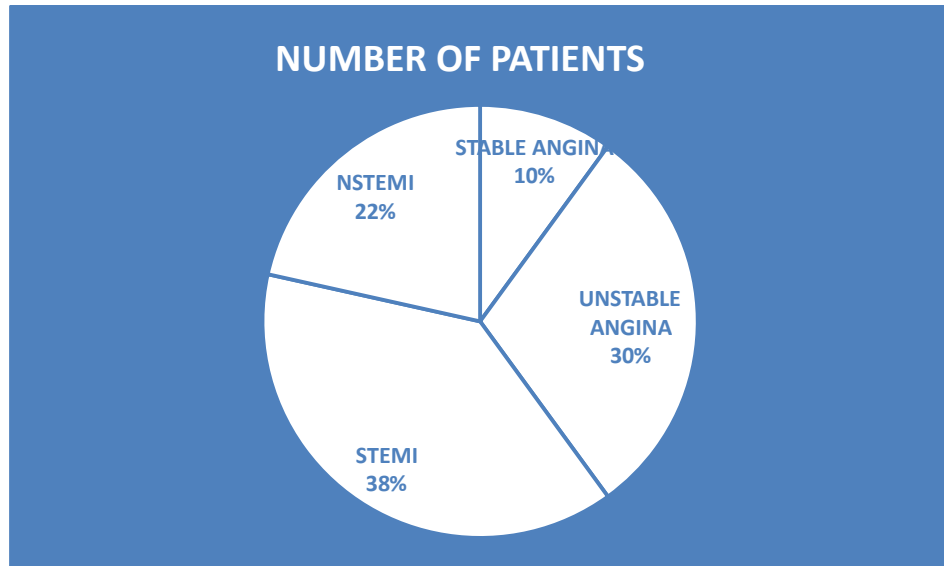


FIGURE 5.3 REPRESENT THE DIAGNOSIS OF THE PATIENTS

TABLE 5.4 CHANGES IN AORTIC SYSTOLIC DIAMETER

AORTIC SYSTOLE RANGES	NUMBER OF HYPERTENSIVE PATIENTS	NUMBER OF NORMOTENSIVE PATIENTS
ELEVATED	68	22
NORMAL	32	78

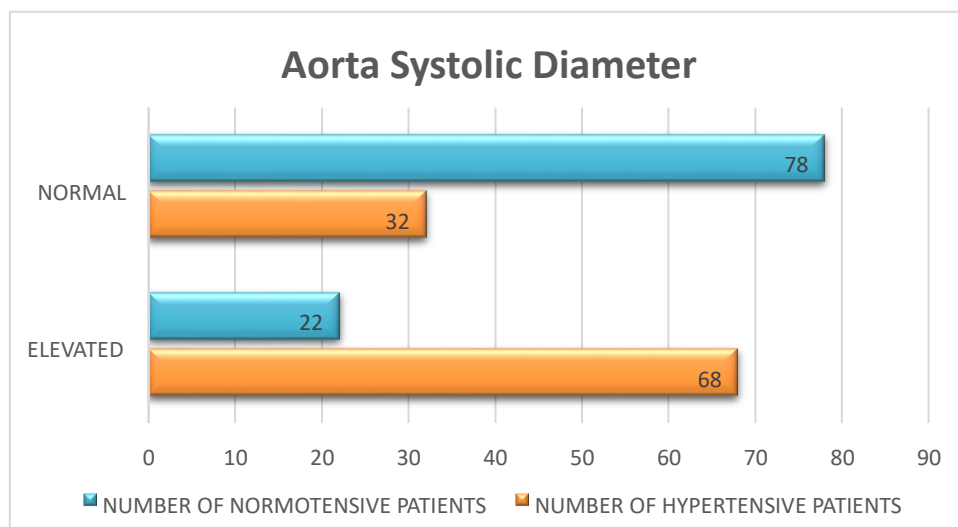


FIGURE 5.4 REPRESENT THE SYSTOLIC DIAMETERS

TABLE 5.5 CHANGES IN AORTIC DIASTOLIC DIAMETER

AORTIC DIASYSTOLE RANGES	NUMBER OF HYPERTENSIVE PATIENTS	NUMBER OF NORMOTENSIVE PATIENTS
ELEVATED	86	44
NORMAL	14	56

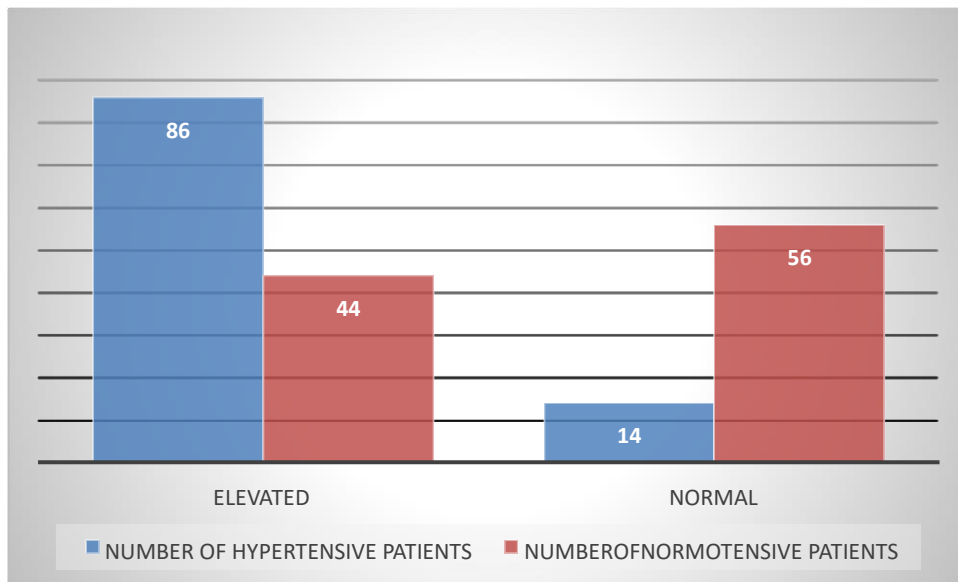


FIGURE 5.5 REPRESENT THE DIASTOLIC DIAMETER

TABLE 5.6 AORTIC STRAIN SEVERITY IN HYPERTENSIVE PATIENTS

AORTIC STRAIN RANGES	NUMBER OF PATIENTS
ELEVATED	76 %
NORMAL	24 %

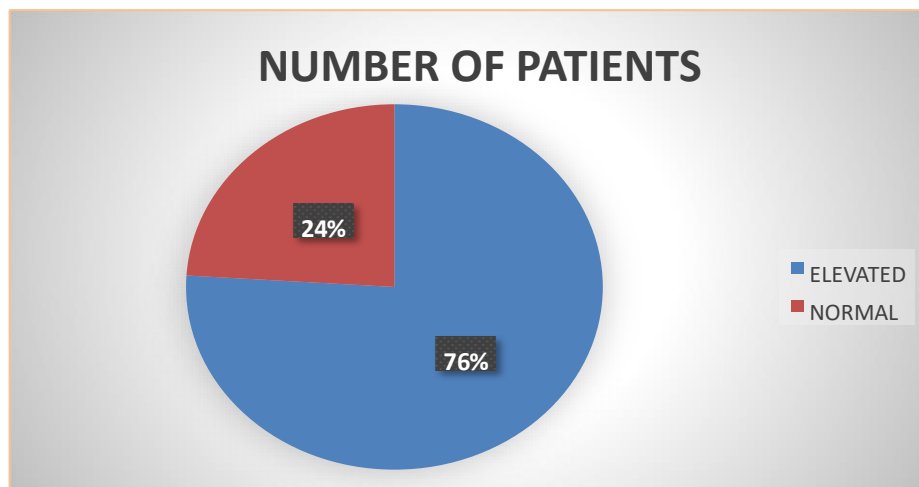


FIGURE 5.6 REPRESENT THE RANGES OF AORTIC STRAIN IN HYPERTENSIVE PATIENTS

TABLE 5.7 AORTIC STRAIN SEVERITY IN NORMOTENSIVE PATIENTS

AORTIC STRAIN RANGES	NUMBER OF PATIENTS
ELEVATED	32 (29%)
NORMAL	78(71%)

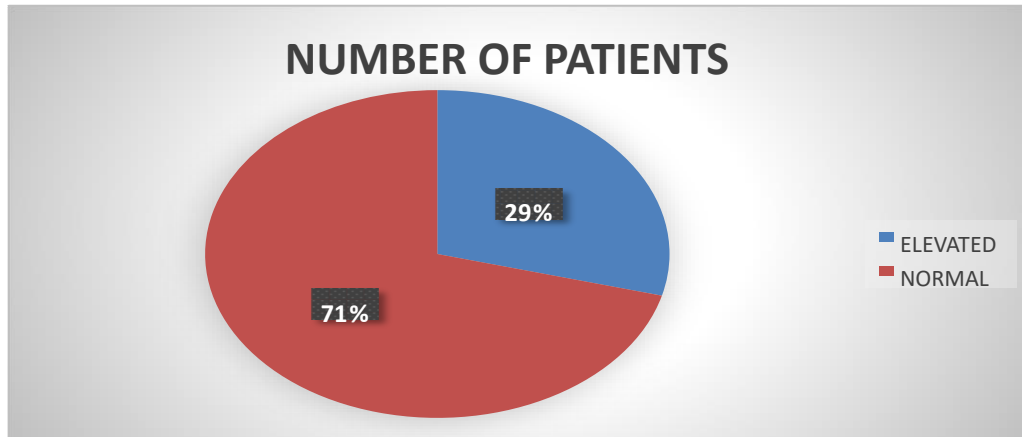


FIGURE 5.7 REPRESENT THE RANGES OF AORTIC STRAIN IN NORMOTENSIVE PATIENTS

TABLE 5.8 CORONARY ANGIOGRAPHIC FINDINGS:

TYPES OF VESSEL DISEASE	HYPERTENSIVE PATIENTS	NORMOTENSIVE PATIENTS
SVD	18	30
DVD	26	21
TVD	40	19
Normal coronaries with Myocardial Bridging, Slow Flow	16	40

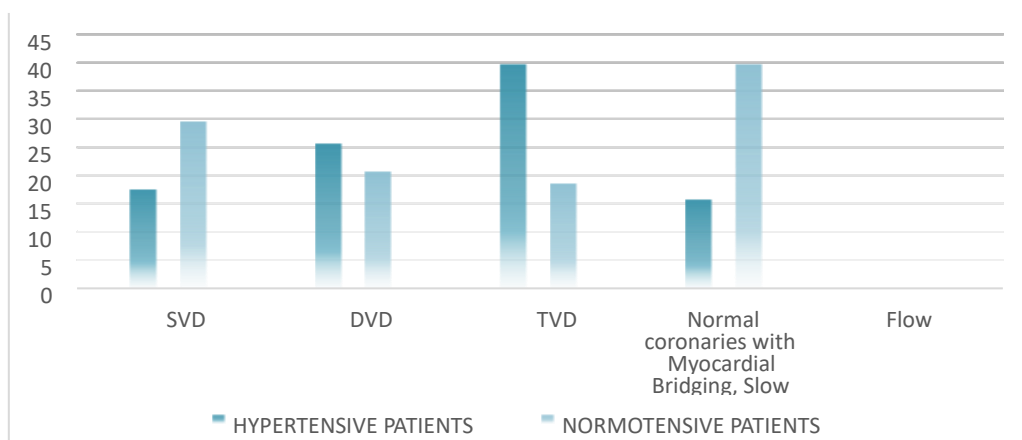


FIGURE 5.8 REPRESENT THE CORONARY ANGIOGRAPHIC FINDINGS

TABLE 5.9 LOW RISK FACTOR OF AORTIC ELASTICITY INDEX

Types of Vessels	HYPERTENSIVE (24)	NORMOTENSIVE (78)
SVD	8	22
DVD	3	13
TVD	2	7
Normal Coronaries	11	36

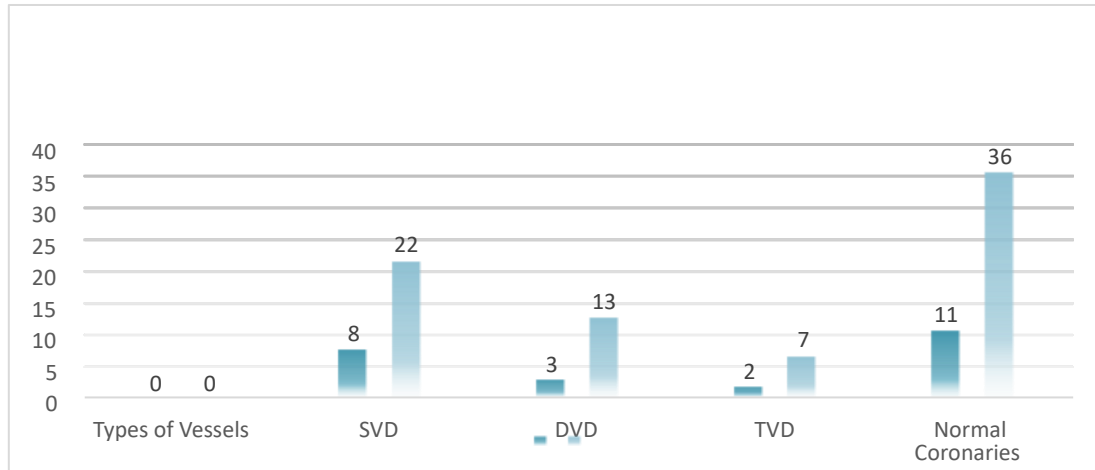


FIGURE 5.9 REPRESENT THE LOW RISK OF THE AORTIC ELASTICITY INDEX OF THE DEGREE OF CAD

TABLE 5.10 HIGH RISK FACTOR OF AORTIC ELASTICITY INDEX

Types of Vessels	Hypertensive(76)	Normotensive(22)
SVD	10	4
DVD	23	6
TVD	38	10
Normal Coronaries	5	2

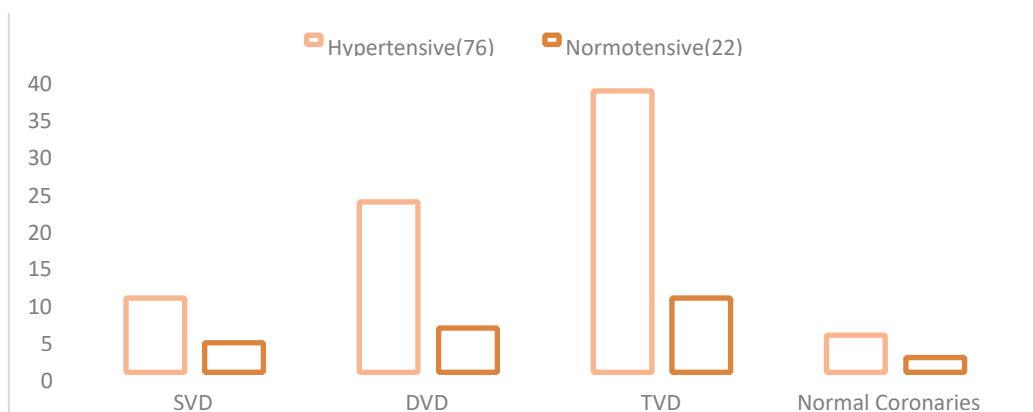


FIGURE 5.10 REPRESENT THE HIGH RISK OF THE AORTIC ELASTICITY INDEX OF THE DEGREE OF CAD

DISCUSSION:

The study was done in cardiology department in Chettinad super speciality hospital, kelambakkam. The study was conducted within 200 patients. The patients were admitted in Cath ICU for the complaints of Angina and underwent Coronary Angiogram. In that, hypertension patients and normotensive patients were included in this study. Those patient's aorta measurements were measured and aortic strain was calculated (5). Usually, aorta is measured in Systole but for this study, aorta diameter is measured both in systole and diastole to calculate the aortic elasticity index simply by the M-mode (6).

The aorta elasticity parameters such as aorta systolic diameter and aorta diastolic diameter is calculated and aortic strain was measured. In Hypertensive patients, the aortic systolic diameter of 68 patients and aorta diastolic diameter of 86 patients were elevated. The Normotensive patients have aortic systolic diameter of 22 and aorta diastolic diameter of 44 were elevated. The Aortic elasticity index is elevated in 76% of patients in hypertensive and 29% in normotensive patients.

Out of 100 Hypertensive patients, 18 were Single vessel disease, 26 were double vessel disease, 40 triple vessel disease, 16 were normal coronaries and out of 100 normotensive patients, 30 were Single vessel disease, 21 were double vessel disease, 19 were triple vessel disease, 40 were normal coronaries. Thus, hypertensive patients have high risk of CAD when compared to normotensive patients.

The High-risk category shows 10 were SVD, 23 were DVD, 38 were TVD, 5 were Normal coronary and the low risk shows 22 were SVD, 13 were DVD, 7 were TVD, 36 were Normal coronaries.

The age group patients around 46 to 75 have high risk of CAD and the age group of patients below 30 have low risk of CAD.

Ali Yildiz (1) also revealed the severity of coronary atherosclerosis may be independently predicted by the aortic elasticity index, and that AD and AS were independently linked to the severity of CAD. S Laurent (2) says that in patients with essential hypertension, aortic stiffness measures cardiovascular and all-cause mortality independently. C Stefanadis (3) claims that aortic elastic characteristics are strong and independent risk factors for recurrent acute coronary episodes in patients with coronary artery disease. Jae Yeong Cho (4) says that echocardiography may be a useful technique for assessing arterial stiffness, particularly local stiffness.

Dernellis J (5) study offers the first concrete proof in a long-term investigation that aortic stiffness is a reliable indicator of the development of hypertension in non-hypertensive people. Nemes A (6) states one promising challenge for echocardiography is the non-invasive evaluation of aortic stiffness.

CONCLUSION:

Echocardiography plays as a promising tool in the evaluation of aortic stiffness. In this study, 200 patients were included from which 100 were hypertensive and 100 were normotensive. From whom the aortic strain was calculated by using aortic systole diameter and aortic diastolic diameter. Which was used to correlate with the severity of CAD. The aortic elasticity showed predominantly increased severity of CAD in hypertensive patient when compared to normotensive patient. Thus, Aortic Elasticity contributes an important role in predicting the CAD severity in hypertensive patients. The largescale study needed to confirm this study.

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