

## THE ASSOCIATION BETWEEN LOW DIASTOLIC BLOOD PRESSURE AND HIGH ATHEROSCLEROTIC VASCULAR BURDEN IN PATIENTS WITH CORONARY ARTERY DISEASE

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### ABSTRACT

#### BACKGROUND

Coronary Artery Disease (CAD) has emerged as the single most important cause of death worldwide in the past decade. Hypertension, both systolic and diastolic are among the major coronary artery disease risk factors. However, the relation between low diastolic blood pressure and severity of CAD is yet to be established. The aim of the present study is to assess the association of low diastolic blood pressure (DBP) levels with high atherosclerotic burden in coronary artery disease (CAD) patients.

#### METHODS

Among the 184 patients who underwent diagnostic cardiac catheterization at Cardiology Department, King George Hospital, Visakhapatnam between Feb-2018 to July-2018, we included 50 patients who satisfied our inclusion criteria.

#### RESULTS

In our study, out of 50 coronary artery disease patients enrolled in the study, 34 members (68%) were males and remaining 16 members (32%) were female patients. From the results, we observed that the prevalence of CAD was higher in male population compared to female population.

#### CONCLUSIONS

CAD was predominant in males than in females. In coronary artery disease patients, a low DBP had an independent significant association with increasing the atherosclerotic burden in coronary arteries, identified by high SYNTAX Score. A DBP <70 mmHg in CAD patients further worsens the disease severity and complexity.

**HOW TO CITE THIS ARTICLE:** Hemamalini KP, Veera Raghavulu B, Annapurna A, et al. The association between low diastolic blood pressure and high athero-sclerotic vascular burden in patients with coronary artery disease. *J. Evid. Based Med. Healthc.* 2019; 6(14), 1109-1112. DOI: 10.18410/jebmh/2019/232

#### BACKGROUND

Coronary Artery Disease (CAD) also described as Coronary Heart Disease (CHD), Ischaemic Heart Disease (IHD); is a condition in which there is an inadequate supply of blood and oxygen to a portion of the myocardium; it typically occurs when there is an imbalance between myocardial oxygen supply and demand. The most common cause of myocardial ischemia is atherosclerotic disease of an epicardial coronary artery (or arteries) sufficient to cause a regional reduction in myocardial blood flow and inadequate perfusion of the myocardium that could lead to heart attack.<sup>1</sup>

Cardiovascular diseases, especially coronary heart disease (CHD) is the major cause of mortality and morbidity all over the world. Globally, CVD led to 17.5 million deaths

*Financial or Other, Competing Interest: None.*

*Submission 14-03-2019, Peer Review 18-03-2019,*

*Acceptance 25-03-2019, Published 02-04-2019.*

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*DOI: 10.18410/jebmh/2019/232*



in 2012. While the prevalence and mortality due to CHD is declining in the developed nations it has been raising rapidly in developing countries.<sup>2</sup> There has been an alarming increase over the past two decades in the prevalence of CHD and cardiovascular mortality in India and other south Asian countries. In 1960 the prevalence of IHD in urban India was 2% and increased 7-fold to  $\approx 14\%$  by 2013.<sup>3</sup>

Hypertension is one of the risks in the development of CHD especially in elders. Isolated systolic hypertension, defined as a systolic blood pressure  $\geq 160$  mmHg and a diastolic blood pressure <90 mmHg is associated with an increased risk of cardiovascular disease, stroke and all-cause mortality in men and women independent of other risk factors. It is an indication of loss of arterial elasticity, can result in hardening and narrowing of arteries, which offers resistance to the blood flow and making them more vulnerable to the plaque build-up associated with atherosclerosis. Hypertension predisposes to atherosclerosis through a shared synergistic mechanism involving inflammation and oxidative stress in the arterial wall. The Joint National Committee VII report developed a new classification of blood pressure, in that including a new category called prehypertension, since these individuals are

at increased risk of progression to hypertension and show an independent increased in risk of cardiovascular disease.<sup>4</sup>

### Aim of the Study

The aim of the present study is to assess the association of low diastolic blood pressure (DBP) levels with high atherosclerotic burden in coronary artery disease (CAD) patients.

### Objectives of the Study

- To assess the relationship between the diastolic blood pressure (DBP) levels and the atherosclerotic burden in coronary artery disease patients.
- Assessment of atherosclerotic burden in CAD patients with Hypertension.
- To assess the atherosclerotic burden in coronary artery disease patients by using SYNTAX Score.

## METHODS

### Study Site

The study was conducted in Cardiology Department (in-patients ward), King George Hospital, Visakhapatnam as a part of academic research work.

### Study Design

Hospital based prospective study.

### Source of Data

Data was collected from the in-patients of Cardiology ward, with coronary artery disease who satisfied the inclusion criteria. Patient's demographic data, clinical data was collected from patient's case sheet, personal interview with subjects and angiographic data was collected from catheterization lab of KGH.

### Study Period

The study was conducted for period of six months (Feb-2018 to July-2018).

### Sample Size

N= 50.

### Inclusion Criteria

Among the 184 patients who underwent diagnostic cardiac catheterization at Cardiology Department, King George Hospital, Visakhapatnam between Feb-2018 to July-2018, we included 50 patients who satisfied the following criteria.

1. Coronary artery disease patients of both sexes between the age groups of 30-80 years.
2. Coronary lesions with a Diameter Stenosis >50% in one or more epicardial coronary arteries.
3. Each coronary lesion with significant stenosis (>50%) in vessels of 1.5 mm or more diameter.
4. Subjects who were willing to give Informed Consent Form (ICF).

### Exclusion Criteria

1. Patients who were not willing to give Informed Consent Form (ICF) were excluded from the study.
2. Patients who had experienced the prior revascularization procedures (PCI or CABG) were excluded from the study.
3. Patients with diabetes mellitus were excluded from the study.
4. Patient's age below 30 years and above 80 years were also excluded from the study.

### Tools Used

1. Study consent form.
2. Semi structured questionnaire form to collect the patient's demographic data.
3. Recorded Angiogram reports (CDs) from Catheterization lab to calculate the SYNTAX Score.
4. SYNTAX Score calculator version 2.28.
5. Chi-Square test calculator (online).
6. Microsoft Excel version windows 7.

## RESULTS

Among the 184 patients who underwent diagnostic cardiac catheterization at Cardiology Department, King George Hospital, Visakhapatnam between Feb-2018 to July-2018, we enrolled 50 patients into the study who satisfied the inclusion criteria. From the patient's angiographic data (CDs) SYNTAX Score was calculated to assess the frequency of atherosclerotic burden and categorized as low, intermediate and high SYNTAX Scores.

Of 50 coronary artery disease patients enrolled into the study, 34 members (68%) were males and remaining 16 members (32%) were female patients. From the results we observed that the prevalence of CAD was higher in male population compared to female population.

In the present study, age groups between 30 to 80 years of both sexes were taken into the study. Out of them 3 (6%) patients were within 30-39 yrs. of age group, 12 (24%) patients were within 40-49 yrs. of age group, 24 (42%) patients were under 50-59 yrs. of age group, 12 (24%) patients were within 60-69 yrs. of age group and 2 (4%) patients were within >70 yrs. of age group. From the results we found that, the prevalence of coronary artery disease was higher in 50-59 years of age group patients (n=s21, 42%).

Syntax Score	n	Percentage (%)
Low (0-22)	22	44
Intermediate (22-32)	17	34
High (>32)	11	22

**Table 1. Syntax Score Wise Distribution of Coronary Artery Disease Patients (n=50)**

Out of 50 patients 22 (44%) patients have low syntax score, 17 (34%) patients have intermediate syntax score and 11 (22%) patients have high syntax score. Majority of patients (22 members, 44%) from study population were under Low SYNTAX Score (0-22), indicated that the disease

severity and complexity in those patients is less compared to intermediate and high syntax score patients.

DBP mmHg	n	Percentage (%)
60-79	22	44
80-99	21	42
>100	7	14
Total	50	100

**Table 2. DBP (Diastolic Blood Pressure) Wise Distribution of Coronary Artery Disease Patients (N=50)**

In the present study, diastolic blood pressure levels (DBP) are noted from the entire study population N=50 and divided into three groups as 60-79, 80-99 and >100 mm Hg. Out of 50 patients, 22 (44%) patients were under 60-79 mm Hg group. 21 (42%) patients were under 80-99 mm Hg group and 7 (14%) patients were under above 100 mm Hg group. From the results we found that, majority of the patients have DBP levels under 60-79, 80-99 mm Hg groups but the prevalence is slightly higher in 60-79 mm Hg DBP group (44%, n=22) than in 80-99 mm Hg DBP group (42%, n=21).

DBP (mmHg)	Syntax Score					
	Low		Intermediate		High	
	n	%	n	%	n	%
60-79	5	10	8	16	9	18
80-99	15	30	5	10	1	2
>100	2	4	4	8	1	2

**Table 3. Percentage Incidence DBP Levels in Different Syntax Score Tertiles**

In 60-79 mm Hg DBP group 5 (10%) patients have low score, 8 (16%) have intermediate and 9 (18%) have high syntax score. In 80-99 mm Hg DBP group 15 (30%) patients have low score, 5 (10%) have intermediate and 1 (2%) have high syntax score. In >100 mmHg DBP group 2 (4%) patients have low score, 4 (8%) have intermediate and 1 (2%) have high syntax score. From the results we found that, in 60-79 mm Hg DBP group (n=22, 44%) majority of patients (n=9, 18%) have high syntax score indicated that these group patients were at high risk. In 80-99 mm Hg DBP group (n=21, 42%) majority of patients (n=15, 30%) have low syntax score shows that they were at safe margin. In >100 mm Hg DBP group (n=7, 14%) majority of patients (n=4, 8%) have intermediate syntax score indicated that they were at moderate risk.

DBP (mmHg)	Syntax Score			Chi Square Value	p-Value
	Low	Intermediate	High		
60-79 n= 22	5 (9.68) (2.26)	8 (7.78) (0.04)	9 (4.84) (3.58)	14.6	0.005
80-89 n=21	15 (9.24) (3.59)	5 (7.14) (0.64)	1 (4.62) (2.84)		
>90 n= 7	2 (3.08) (0.38)	4 (2.38) (1.10)	1 (1.54) (0.19)		

**Table 4. Syntax Scores and Chi Square Values**

(Numbers in parenthesis indicates Expected values and numbers in square brackets indicates respective cell chi-square values).

In our study, association between DBP levels and atherosclerotic burden was assessed by using Chi-square test. The hypothesis low diastolic blood pressure is associated with high syntax score in coronary artery diseases patients is proven to be significant with chi-square value 14.6 and p-value 0.005 which is less than 0.05, indicated that coronary artery disease patients with low diastolic blood pressure increases the atherosclerotic burden as well as disease severity and complexity.

In the present study, patients were categorized based on their comorbidity hypertension. Out of 50 patients suffering with coronary artery disease, 26 (52%) patients were hypertensive and remaining 24 (48%) patients were normotensive. From the result we observed that, the prevalence of hypertension (n=26, 52%) was more in coronary artery disease patients across the total study population.

Comorbidity	N	%
Hypertensive	26	52
Normotensive	24	48
Total	50	100

**Table 5. Comorbidity (Hypertensive/ Normotensive Patients) Wise Distribution of Coronary Artery Disease Patients (N=50)**

Comorbidity	Syntax Score			Chi Square Value	p-Value
	Low	Intermediate	High		
Hypertensive	8 (11.44) (1.03)	9 (8.84) (0.00)	9 (5.72) (1.88)	6.07	0.047
Non-Hypertensive	14 (10.56) (1.12)	8 (8.16) (0.00)	2 (5.28) (2.04)		

**Table 6. Association Between Hypertension and Atherosclerotic Burden**

(Numbers in parenthesis indicates Expected values and numbers in square brackets indicates respective cell chi-square value).

In our study, association between hypertension and atherosclerotic burden was assessed by using Chi-square test. The hypothesis hypertension is associated with high syntax score in coronary artery disease patients is proven to be insignificant with chi-square value 6.07 and p-value 0.047 which is less than 0.05, indicated that hypertension is associated with increasing atherosclerotic burden and complexity in coronary artery disease patients.

## DISCUSSION

In our study, coronary artery disease patient's atherosclerotic burden was quantified by using SYNTAX Score and it is divided into three groups as low, intermediate and high scores. Low syntax score indicates low risk, intermediate indicates moderate risk and high score indicates high frequency of atherosclerotic burden, high severity and complexity. The SYNTAX Score is a useful tool to stratify risk outcomes in stable patients with complex CAD who have undergone revascularization by PCI or CABG. A high SYNTAX Score is correlated with a poor prognosis, which is also a marker of systemic atherosclerotic burden (V. Senthong et al., 2017).<sup>5</sup>

In patients with stable CAD and with hypertension, a low DBP (<70 mm Hg) was associated with subclinical myocardial damage and adverse cardio vascular outcomes (Vidal-Petiot E et al., 2016).<sup>6</sup> In a study by V. Senthong et al.,<sup>5</sup> intensive reduction in DBP would expected to decrease coronary perfusion pressure that would be associated with subclinical myocardial damage, which may be mechanically linked with the development of high severity of an atherosclerotic burden of coronary vessels. Lower DBP levels were found to be independent predictor of higher SYNTAX Score.<sup>5</sup> Compared with a DBP of 80 to 89 mm Hg, DBP below 60 mm Hg significantly increased the risk of progressively worsening myocardial damage at any given systolic blood pressure. Diastolic blood pressure under 60 mm Hg significantly increased the chances of incident CHD and death, but not stroke.<sup>7</sup>

Clinical, experimental and pathologic studies strongly indicate that hypertension is a major factor, has been consistently correlated with increased probability of developing CAD in various populations.<sup>8</sup> Increased pressure on arteries induces loss of arterial elasticity, leads to hardening and narrowing of arteries, which offers resistance to the blood flow and making them more vulnerable to the plaque build-up associated with atherosclerosis.<sup>4</sup> The epidemiological studies are supported by experimental evidence postulating that hypertension predisposes to

atherosclerosis through a shared synergistic mechanism involving inflammation and oxidative stress in the arterial wall. Shikada T et al reported that hypertension was associated with an increased risk of incident coronary calcification, is a part of atherosclerotic process and a surrogate marker of the total coronary atherosclerotic burden.<sup>9</sup>

## CONCLUSION

In coronary artery disease patients, a low DBP had an independent significant association with increase in the atherosclerotic burden in coronary arteries, identified by high SYNTAX Score. A DBP <70 mmHg in CAD patients further worsens the disease severity and complexity. CAD was predominant in males than in females.

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