



**STUDY OF VARIOUS RISK FACTORS AND CARDIAC PATHOLOGY (MAINLY ATHEROSCLEROTIC CORONARY ARTERY DISEASE) IN YOUNG ADULTS- AN AUTOPSY BASED PROSPECTIVE STUDY**

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**ABSTRACT**

Cardiovascular disease is now the most common cause of death worldwide. The sudden death in apparently healthy young individuals is always a devastating and shocking event. According to WHO, Ischemic Heart Disease is our modern epidemic. The occurrence of Ischemic Heart Disease in developing countries is a decade earlier compared with the age incidence in developed countries. Now because of change in lifestyle and habits, atherosclerotic coronary artery disease is noticed in comparatively younger age group even in a developing country like India. Bangalore is an IT hub. Many IT Professionals are working in this city. We have noticed atherosclerotic coronary artery disease, occurring in young IT professionals because of their sedentary lifestyles, smoking and drinking (alcohol) habits. Hence an autopsy based prospective study was conducted at the department of Forensic Medicine, Victoria Hospital, Bangalore Medical College & Research Institute, Bangalore, over a period of 18 months from November 2013 to May 2015, in young adults aged between 18 to 40 years dying due to various reasons like road traffic accidents, poisoning, burns, hanging, sudden natural deaths, assaults, electrocution, snake bite etc, and autopsy findings of total 200 cases subjected for medicolegal autopsy were studied, to know various risk factors associated with cardiac pathology (mainly atherosclerotic coronary artery disease), so that we can counsel the close family members of the deceased and other individuals to go through essential investigations and take preventive measures. In this way we can protect the close family members of the deceased and other individuals from fatal cardiac pathologies (mainly atherosclerotic coronary artery disease) in future. Out of 200 cases, majority of cases 143 (71.5%) cases showed underlying Atherosclerotic Coronary Artery Disease of different grades and different extent of luminal narrowing which also included fixed coronary obstruction, thrombus, recent and healed Myocardial Infarction. Most of them were male belonged to 26-33 years age group.

Other significant cardiac lesions encountered were Pericarditis, Valvular heart disease including Rheumatic heart disease, Arrhythmogenic Right Ventricular Dysplasia, Myocarditis, Concentric Left ventricular hypertrophy, Biventricular hypertrophy, Cardiac Polyp, Anomalous/Aberrant Coronary artery, Hypertrophic cardiomyopathy, Dilated cardiomyopathy, Pancarditis and Coronary artery Vasculitis. In most of the cases these other underlying cardiac pathological lesions were found in association with atherosclerotic coronary artery disease.

Both frequency and duration of smoking (cigarette/beedi) and alcohol consumption, lack of physical exercise, history of respiratory diseases, family history of hypertension, age, sex and BMI showed significant relationship with cardiac pathology mainly atherosclerotic coronary artery disease. In case of IT Professionals, daily working hours, working days in a week and monthly holidays did not show any statistically significant relationship with the cardiac pathology. Heart weight was also found to increase with body weight, body length and BMI.

Atherosclerotic coronary artery disease was the most frequently encountered underlying cardiac pathology even in young adults. It is a matter of concern. People should stop smoking cigarettes/beedis and reduce the consumption of alcohol, do some sort of moderate physical exercises regularly, focus on the dietary habits to maintain normal weight, check their blood pressure and sugar levels at regular interval and take proper medications.

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**INTRODUCTION**

The human heart is a remarkably efficient, durable, and reliable pump, distributing more than 6000 litres of blood through the body each day, and beating 30 to 40 million times a year- providing tissues with vital nutrients and facilitating waste excretion.

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Consequently, cardiac dysfunction can have devastating physiologic consequences. Cardiovascular disease is the number one cause of worldwide mortality, with about 80% of the burden occurring in developing countries.

Sudden cardiac death is most commonly defined as unexpected death from cardiac causes either without symptoms, or within 1 to 24 hours of symptom onset (different authors use different criteria). Coronary artery disease is the leading cause of sudden cardiac death, responsible for 80% to 90% of cases.

Unfortunately sudden cardiac death is often the first manifestation of ischemic heart disease.<sup>1</sup>

The causes of sudden cardiac death differ greatly among various age groups. In individuals > 40 years old, atherosclerotic coronary heart disease is the most common cause. Between 1 to 40 years of age, the causes of sudden cardiac death are commonly hypertrophic cardiomyopathy, myocarditis, congenital heart disease, arrhythmogenic right ventricular dysplasia/ cardiomyopathy etc.<sup>2</sup>

Approximately 80% of sudden cardiac deaths are caused by atherosclerotic coronary artery disease in all its manifestations-fixed coronary obstruction, coronary spasm, plaque rupture and erosion with coronary thrombosis, acute and healed myocardial infarction and chronic ischemia.<sup>3</sup>

Coronary atherosclerosis is sometimes called 'the Captain of the Men of Death'. This is certainly the most frequent cause of sudden death in Western societies.<sup>4</sup>

Atherosclerosis is characterized by intimal lesions called atheromas, or atheromatous or fibrofatty plaques, which protrude into and obstruct vascular lumen and weaken the underlying media. It is a disease of elastic arteries and large and medium sized muscular arteries. It can be considered as a chronic inflammatory response of the arterial wall initiated by injury to the endothelium. Major risk factors for Atherosclerosis are-

1. Nonmodifiable (Constitutional)- Genetic abnormalities, Family history, Increasing age, Male gender.
2. Modifiable- Hyperlipidemia, Hypertension, Cigarette smoking, Diabetes mellitus, Inflammation.

The specific cause of endothelial dysfunction in early atherosclerosis is unknown; potential culprits include circulating derivatives of cigarette smoke, homocysteine and possibly viruses and other infectious agents. Two most important determinants of endothelial alterations are thought to be hemodynamic disturbances and adverse effects of hypercholesterolemia. Chronic hypercholesterolemia may directly impair endothelial cell function through increased production of oxygen free radicals that deactivate nitric oxide (NO), the major endothelial relaxing factor.<sup>5</sup>

Ischemic heart disease (IHD) is the generic designation for a group of closely related syndromes resulting from myocardial ischemia—an imbalance between the supply (perfusion) and demand of the heart for oxygenated blood. Ischemia comprises not only insufficiency of oxygen, but also reduced availability of nutrient substrates and inadequate removal of metabolites. In more than 90% of cases, the cause of myocardial ischemia is reduction in coronary blood flow due to atherosclerotic coronary arterial obstruction. Thus, IHD is often termed coronary artery disease (CAD) or coronary heart disease. In most cases, there is a long period (decades) of silent, slowly progressive, coronary atherosclerosis before these disorders become manifest.<sup>1</sup>

According to WHO, Ischemic Heart Disease is our modern epidemic. The occurrence of Ischemic Heart Disease in developing countries is a decade earlier compared with the age incidence in developed countries.

The sudden death in apparently healthy young individuals is always a devastating and shocking event. Now because of change in lifestyle and habits, atherosclerotic coronary artery disease is noticed in comparatively younger age group even in a developing country like India.

Bangalore is an IT hub. Many IT Professionals are working in this city. We have noticed atherosclerotic coronary artery disease, occurring in young IT professionals because of their sedentary lifestyles, smoking and drinking (alcohol) habits.

Hence I, at the department of Forensic Medicine, Victoria Hospital, Bangalore Medical College & Research Institute, Bangalore did an autopsy based prospective study in young adults aged between 18 to 40 years dying due to various reasons like road traffic accidents, poisoning, burns, hanging, sudden natural deaths, assaults, electrocution, snake bite etc, to know various risk factors associated with cardiac pathology (mainly atherosclerotic coronary artery disease), so that we can counsel the close family members of the deceased and other individuals to go through essential investigations and take preventive measures. In this way we can protect the close family members of the deceased and other individuals from fatal cardiac pathologies (mainly atherosclerotic coronary artery disease) in future.

**Aims and Objectives:** To know various risk factors associated with cardiac pathology (mainly atherosclerotic coronary artery disease) in young adults dying due to various reasons.

## **MATERIALS AND METHODOLOGY**

**Source of data-** The present study has been carried out in the Department of Forensic Medicine and Toxicology and Department of Pathology, Victoria Hospital, attached to Bangalore Medical College and Research Institute, Bangalore during the period November 2013 to May 2015. Dead bodies of young adults aged between 18 to 40 years dying due to various reasons like road traffic accidents, poisoning, burns, hanging, sudden natural deaths, assaults, electrocution, snake bite etc, subjected for medicolegal autopsy in the mortuary of Department of Forensic Medicine and Toxicology, Victoria Hospital, Bangalore. Total 200 cases were selected randomly by simple random sampling method for this prospective study.

**Ethical clearance-** Ethical clearance for this study was obtained from the Institution's Ethical Committee, Bangalore Medical College & Research Institute, Bangalore prior to the conduction of study.

**Method of collection of data-** After explaining the details of the study, the history related to the deceased was obtained from close relatives in each case and entered in a proforma prepared for this particular study. The proforma contains demographic information related to the deceased like age, sex, address, education, occupation, monthly family income and other personal information like habits of smoking, drinking alcohol, tobacco chewing, drug addictions, life style, physical exercises, sports activities, history of taking nutritional supplements for body building, history of stress, health status prior to death, family history of any disease like diabetes, hypertension, heart disease etc, history of taking any particular medicine regularly. In case of IT Professionals additional information regarding their daily working hours, total working days in a week and monthly holidays, were taken. After taking

detailed history from the concerned police about the incidence thorough post mortem examination was conducted.

After examining the pericardium heart was removed and examined thoroughly. First gross examination was done and relevant photographs were taken. In each case heart was dissected according to inflow-outflow technique described by Virchow. The parameters which were recorded are weight of heart, left ventricular wall thickness, right ventricular wall thickness, inter ventricular septum thickness, condition of valves, condition of main vessels including right & left coronaries, aorta & pulmonary trunk, assessment of chamber size and assessment of papillary muscles & chordae tendinae. The patency of the four major epicardial coronary trunks was analyzed by taking transverse sections at 3-mm intervals. Representative sections were taken for histopathological examination after fixing in 10% Formalin solution. Then after subjecting the tissue sections to routine tissue processing, paraffin blocks were prepared by embedding the tissue in paraffin wax and 4 to 5 micron thick slide sections were prepared and stained with haematoxylin & eosin. Special stains were employed wherever it was necessary. Finally, the gross findings and the histopathological findings were correlated and entered in the proforma.

**Methodology for data analysis-** Data was analyzed using descriptive statistics and chi-square test. Suitable statistical software was utilized for analysis and presented in the form of tables wherever necessary.

**Inclusion criteria**

1. Young adults aged between 18 to 40 years dying due to various reasons like road traffic accidents, poisoning, burns, hanging, sudden natural deaths, assaults etc.
2. Both sexes (Male and Female).

**Exclusion criteria**

1. Individuals aged less than 18 years and more than 40 years.
2. Decomposed bodies.
3. Extensively mutilated bodies.
4. Cases in which there is mechanical injury to the heart.
5. Unknown bodies.

**OBSERVATIONS AND RESULTS**

During the study period from November 2013 to May 2015, various risk factors and autopsy findings of total 200 cases were studied prospectively in the Department of Forensic Medicine, Victoria Hospital, Bangalore Medical College and Research Institute, Bangalore.

**The observations of this study are as follows**

Out of total 200 cases which included 156 (78%) males and 44 (22%) females of age between 18 years to 40 years, dying due to various reasons like road traffic accidents, poisoning, burns, hanging, sudden natural deaths, assaults, electrocution, snake bite etc, majority of cases, total 143(71.5%) showed atherosclerotic coronary artery disease (including fixed coronary obstruction, thrombus, recent and healed myocardial infarction) of different grades and different extent of luminal narrowing. Out of which 117 (81.8%) were males and 26 (18.2%) were females. Majority of cases of Atherosclerotic coronary artery disease were in the age group 26-33 years which include 35% males and 7% females, followed by 34-40

years which include 27.2% males and 6.3% females, and 18-25 years which include 19.6% males and 4.9% females respectively.

Out of 200 cases, 51 (25.5%) were found to be normal. Out of which 34 were males and 17 were females, majority 27 (52.9%) were in the age group of 18-25 years.

Other significant underlying cardiac pathologies were Pericarditis 7 (3.5%), Valvular heart disease including Rheumatic heart disease 7 (3.5%), Arrhythmogenic Right Ventricular Dysplasia 2 (1%), Myocarditis 4 (2%), Concentric Left ventricular hypertrophy 4 (2%), Biventricular hypertrophy 4 (2%), Cardiac Polyp 2 (1%), Anomalous/Aberrant Coronary artery 2 (1%), Hypertrophic cardiomyopathy 1 (0.5%), Dilated cardiomyopathy 1 (0.5%), Pancarditis 1 (0.5%) and Coronary artery Vasculitis 1 (0.5%).

**Association between various risk factors and cardiac pathology (mainly atherosclerotic coronary artery disease)-**

**Table 1** Association between age and cardiac pathology

Age Group	Cardiac Pathology		Total
	Absent	Present	
18 to 25 years	30	35	65
26 to 33 years	14	61	75
34 to 40 years	12	48	60
Total	56	144	200

$\chi^2 = 15.77, df = 2, p = 0.000$ , statistically significant.

In this study we found that there is a statistically significant relationship between the age and cardiac pathology. As the age increases the chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 2** Association between Sex and cardiac pathology

Sex	Cardiac Pathology		Total
	Absent	Present	
Male	38	118	156
Female	18	26	44
Total	56	144	200

$\chi^2 = 4.66, df = 1, p = 0.031$ , statistically significant.

In this study we found that there is a statistically significant relationship between the sex and cardiac pathology. Male sex has more chances of having cardiac pathology mainly atherosclerotic coronary artery disease as compared to female sex.

**Table 3** Association between smoking frequency and cardiac pathology

Smoking Frequency (Cigarette/Beedi)	Cardiac Pathology		Total
	Absent	Present	
No Smoking	43	60	103
Occasional	4	13	17
<1 Pack	7	33	40
1-2 Pack	2	38	40
>2 Pack	0	0	0
Total	56	144	200

$\chi^2 = 22.5, df = 3, p = 0.000$ , statistically significant.

In this study we found a statistically significant relationship between smoking frequency and cardiac pathology. As the number of packs of cigarette/beedi smoking increases chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 4** Association between smoking duration and cardiac pathology

Smoking Duration	Cardiac Pathology		Total
	Absent	Present	
No Smoking	43	60	103
<5 Years	8	18	26
5-10 Years	5	48	53
11-15 Years	0	15	15
>15 Years	0	3	3
Total	56	144	200

$\chi^2 = 25.82$ ,  $df = 4$ ,  $p = 0.000$ , statistically significant.

In this study we found a statistically significant relationship between smoking duration and cardiac pathology. As the number of years of cigarette/beedi smoking increases chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 5** Association between alcohol intake frequency and cardiac pathology

Alcohol Intake Frequency	Cardiac Pathology		Total
	Absent	Present	
No Alcohol	39	55	94
Occasional	5	18	23
Weekly	4	17	21
Alternate days	1	12	13
Daily	7	42	49
Total	56	144	200

$\chi^2 = 17$ ,  $df = 4$ ,  $p = 0.002$ , statistically significant.

In this study we found a statistically significant relationship between frequency of alcohol intake and cardiac pathology. As the alcohol intake frequency increases chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 6** Association between alcohol intake duration and cardiac pathology

Alcohol Intake Duration	Cardiac Pathology		Total
	Absent	Present	
No Alcohol	39	55	94
<5 Years	10	21	31
5-10 Years	5	52	57
11-15 Years	2	13	15
>15 Years	0	3	3
Total	56	144	200

$\chi^2 = 22$ ,  $df = 4$ ,  $p = 0.000$ , statistically significant.

In this study we found a statistically significant relationship between duration of alcohol intake and cardiac pathology. As the number of years of alcohol intake increases chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 7** Association between tobacco consumption frequency and cardiac pathology

Tobacco Consumption Frequency	Cardiac Pathology		Total
	Absent	Present	
No Tobacco	51	124	175
Occasional	0	4	4
<5 Pack	3	15	18
>5 Pack	2	1	3
Total	56	144	200

$\chi^2 = 5.04$ ,  $df = 3$ ,  $p = 0.169$ , statistically not significant.

In this study we found that there is no statistically significant relationship between frequency of tobacco consumption and cardiac pathology.

**Table 8** Association between tobacco consumption duration and cardiac pathology

Tobacco Consumption Duration	Cardiac Pathology		Total
	Absent	Present	
No Tobacco	51	124	175
<5 Years	3	4	7
5-10 Years	2	13	15
11-15 Years	0	1	1
>15 Years	0	2	2
Total	56	144	200

$\chi^2 = 3.65$ ,  $df = 4$ ,  $p = 0.456$ , statistically not significant.

In this study we found that there is no statistically significant relationship between duration of tobacco consumption and cardiac pathology.

**Table 9** Association between drugs intake (drugs of abuse) frequency and cardiac pathology

Drugs Intake Frequency	Cardiac Pathology		Total
	Absent	Present	
No Drugs	56	139	195
Occasional	0	2	2
Weekly	0	2	2
Alternate days	0	0	0
Daily	0	1	1
Total	56	144	200

$\chi^2 = 2$ ,  $df = 3$ ,  $p = 0.574$ , statistically not significant.

In this study we found that there is no statistically significant relationship between frequency of drugs intake and cardiac pathology.

**Table 10** Association between drugs intake (drugs of abuse) duration and cardiac pathology

Drugs Intake Duration	Cardiac Pathology		Total
	Absent	Present	
No Drugs	56	139	195
<5 Years	0	2	2
5-10 Years	0	3	3
11-15 Years	0	0	0
>15 Years	0	0	0
Total	56	144	200

$\chi^2 = 2$ ,  $df = 2$ ,  $p = 0.369$ , statistically not significant.

In this study we found that there is no statistically significant relationship between duration of drugs intake and cardiac pathology.

**Table 11** Association between life style and cardiac pathology

Life style	Cardiac Pathology		Total
	Absent	Present	
Sedentary	0	6	6
Moderate	48	117	165
Hard Labour	8	21	29
Total	56	144	200

$\chi^2 = 2.43$ ,  $df = 2$ ,  $p = 0.296$ , statistically not significant.

In this study we found that there is no statistically significant relationship between life style of the individual and cardiac pathology.

**Table 12** Association between type of physical exercise and cardiac pathology

Type of Physical Exercise	Cardiac Pathology		Total
	Absent	Present	
Nil	48	122	170
Walking	2	7	9
Running	1	0	1
Cycling	2	7	9
Gym	3	8	11
Total	56	144	200

$\chi^2= 2.88$ ,  $df= 4$ ,  $p= 0.579$ , statistically not significant.

In this study we found that there is no statistically significant relationship between type of physical exercise and cardiac pathology. However lack of physical exercise increases the chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 13** Association between frequency of physical exercise and cardiac pathology

Frequency of Physical Exercise	Cardiac Pathology		Total
	Absent	Present	
Nil	48	122	170
Daily	8	16	24
Occasional	0	6	6
Total	56	144	200

$\chi^2= 2.68$ ,  $df= 2$ ,  $p= 0.262$ , statistically not significant.

In this study we found that there is no statistically significant relationship between the frequency of physical exercise and cardiac pathology. However lack of physical exercise increases the chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 14** Association between nutritional supplement intake and cardiac pathology

Nutritional Supplement Intake	Cardiac Pathology		Total
	Absent	Present	
No	55	142	197
Yes	1	2	3
Total	56	144	200

$\chi^2= 0.04$ ,  $df= 1$ ,  $p= 0.836$ , statistically not significant.

In this study we found that there is no statistically significant relationship between nutritional supplement intake and cardiac pathology.

**Table 15** Association between sport activities and cardiac pathology

Sport Activities	Cardiac Pathology		Total
	Absent	Present	
No	54	135	189
Yes	2	9	11
Total	56	144	200

$\chi^2= 0.56$ ,  $df= 1$ ,  $p= 0.456$ , statistically not significant.

In this study we found that there is no statistically significant relationship between sport activities and cardiac pathology.

**Table 16** Association between stress and cardiac pathology

Stress	Cardiac Pathology		Total
	Absent	Present	
No	50	127	177
Yes	6	17	23
Total	56	144	200

$\chi^2= 0.05$ ,  $df= 1$ ,  $p= 0.828$ , statistically not significant.

In this study we found that there is no statistically significant relationship between stress and cardiac pathology.

**Table 17** Association between Hypertension and cardiac pathology

Hypertension	Cardiac Pathology		Total
	Absent	Present	
No	53	141	194
Yes, Controlled	2	2	4
Yes, Not Controlled	1	1	2
Total	56	144	200

$\chi^2= 1.48$ ,  $df= 2$ ,  $p= 0.476$ , statistically not significant.

In this study we found that there is no statistically significant relationship between hypertension and cardiac pathology.

**Table 18** Association between Diabetes mellitus and cardiac pathology

Hypertension	Cardiac Pathology		Total
	Absent	Present	
No	52	141	193
Yes, Controlled	3	3	6
Yes, Not Controlled	1	0	1
Total	56	144	200

$\chi^2= 4.12$ ,  $df= 2$ ,  $p= 0.128$ , statistically not significant.

In this study we found that there is no statistically significant relationship between diabetes mellitus and cardiac pathology.

**Table 19** Association between previous Heart diseases and present cardiac pathology

Previous Heart Diseases	Cardiac Pathology		Total
	Absent	Present	
No	56	143	199
Yes, Treated	0	0	0
Yes, Not Treated	0	1	1
Total	56	144	200

$\chi^2= 0.4$ ,  $df= 1$ ,  $p= 0.532$ , statistically not significant.

In this study we found that there is no statistically significant relationship between previous heart diseases and present cardiac pathology.

**Table 20** Association between Respiratory diseases and cardiac pathology

Respiratory Diseases	Cardiac Pathology		Total
	Absent	Present	
No	48	141	189
Yes, Treated	6	3	9
Yes, Not Treated	2	0	2
Total	56	144	200

$\chi^2= 12.45$ ,  $df= 2$ ,  $p= 0.002$ , statistically significant.

In this study we found that there is a statistically significant relationship between respiratory diseases and cardiac pathology.

**Table 21** Association between family history of hypertension and cardiac pathology

Family history of Hypertension	Cardiac Pathology		Total
	Absent	Present	
No	56	125	181
Yes	0	19	19
Total	56	144	200

$\chi^2= 8.16$ ,  $df= 1$ ,  $p= 0.004$ , statistically significant.

In this study we found that there is a statistically significant relationship between family history of hypertension and cardiac pathology.

**Table 22** Association between family history of Diabetes mellitus and cardiac pathology

Family history of Diabetes mellitus	Cardiac Pathology		Total
	Absent	Present	
No	54	127	181
Yes	2	17	19
Total	56	144	200

$\chi^2= 3.18$ ,  $df= 1$ ,  $p= 0.075$ , statistically not significant.

In this study we found that there is no statistically significant relationship between family history of diabetes mellitus and cardiac pathology.

**Table 23** Association between family history of heart disease and cardiac pathology

Family history of Heart disease	Cardiac Pathology		Total
	Absent	Present	
No	55	140	195
Yes	1	4	5
Total	56	144	200

$\chi^2= 0.16$ ,  $df= 1$ ,  $p= 0.687$ , statistically not significant.

In this study we found that there is no statistically significant relationship between family history of heart disease and cardiac pathology.

**Table 24** Association between regular medications and cardiac pathology

Regular Medications	Cardiac Pathology		Total
	Absent	Present	
No	51	137	188
Yes	5	7	12
Total	56	144	200

$\chi^2= 1.18$ ,  $df= 1$ ,  $p= 0.277$ , statistically not significant.

In this study we found that there is no statistically significant relationship between taking any regular medicine and cardiac pathology.

**Table 25** Association between Body mass Index (BMI) and cardiac pathology

BMI (kg/m <sup>2</sup> )	Cardiac Pathology		Total
	Absent	Present	
Under weight (<18.5)	2	3	5
Normal (18.5-24.9)	29	49	78
Overweight (25-29.9)	25	92	117
Total	56	144	200

$\chi^2= 6.17$ ,  $df= 2$ ,  $p= 0.046$ , statistically significant.

In this study we found that there is a statistically significant relationship between Body Mass Index (BMI) and cardiac pathology. As the BMI increases the chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

**Table 26** Association between daily working hours and cardiac pathology (In IT Professionals)

Daily Working Hours	Cardiac Pathology		Total
	Absent	Present	
7	0	1	1
8	1	5	6
9	0	2	2
10	0	2	2
Total	1	10	11

$\chi^2= 0.917$ ,  $df= 3$ ,  $p= 0.821$ , statistically not significant.

In this study we found that there is no statistically significant relationship between daily working hours and cardiac pathology in IT Professionals.

**Table 27** Association between working days in a week and cardiac pathology (In IT Professionals)

Working Days in a Week	Cardiac Pathology		Total
	Absent	Present	
5	1	7	8
6	0	3	3
Total	1	10	11

$\chi^2= 0.413$ ,  $df= 1$ ,  $p= 0.521$ , statistically not significant.

In this study we found that there is no statistically significant relationship between working days in a week and cardiac pathology in IT Professionals.

**Table 28** Association between holidays per month and cardiac pathology (In IT Professionals)

Holidays per Month	Cardiac Pathology		Total
	Absent	Present	
4	0	3	3
8	1	7	8
Total	1	10	11

$\chi^2= 0.413$ ,  $df= 1$ ,  $p= 0.521$ , statistically not significant.

In this study we found that there is no statistically significant relationship between holidays per month and cardiac pathology in IT Professionals.

**Table 29** Correlation between different variables with Heart Weight

Variable	Pearson Correlation (r)	p- value	Significance
Body Length	r = 0.364	p= 0.000	Statistically significant
Body Weight	r = 0.367	p= 0.000	Statistically significant
BMI	r = 0.158	p= 0.025	Statistically significant

In this study weight of the heart showed a statistically significant correlation with the length of the body, weight of the body and Body Mass Index (BMI) which was calculated with the weight and length of the body. As the weight, length or BMI of the body increases weight of the heart also increases.

## DISCUSSION

Cardiovascular disease is now the most common cause of death worldwide.<sup>6</sup> Although with the advancement in diagnostic modalities, the correct and complete diagnosis of cardiovascular diseases is now possible, but the world of cardiac pathology is largely autopsy based.

A detailed gross study of the heart with photographic records, and histopathological analysis is still the gold standard against which antemortem cardiologic findings are measured. Hence we did an autopsy based prospective study, at the department of Forensic Medicine, Victoria Hospital, Bangalore Medical College & Research Institute, Bangalore, in young adults aged between 18 to 40 years dying due to various reasons like road traffic accidents, poisoning, burns, hanging, sudden natural deaths, assaults, electrocution, snake bite etc, to know various risk factors associated with cardiac pathology (mainly atherosclerotic coronary artery disease). so that we can counsel

the close family members of the deceased and other individuals to go through essential investigations and take preventive measures. The study period was November 2013 to May 2015 and total 200 cases were studied during study period.

In the present study the ages ranged from 18 to 40 years. Total 156 (78%) were males and 44 (22%) were females.

In the study by Dabit Arzamendi *et al*<sup>7</sup>, in 243 cases of <40 years age, majority 146 cases were in 31-40 years age group. Study by Sanjeet Kumar *et al*<sup>8</sup>, in 50 cases aged between 30-60 years showed 43(86%) males and 7 (14%) females. Out of that 21 males and 2 females were in 30-40 years age group. While study conducted by Abraham Joseph *et al*<sup>9</sup>, in 111 cases aged between 14-35 years showed 95 (85.5%) males and 16 (14.5%) females.

In all these studies males dominated females by large numbers. In the present study, out of total 200 cases, majority of cases 143 (71.5%) cases showed underlying Atherosclerotic Coronary Artery Disease of different grades and different extent of luminal narrowing which also included fixed coronary obstruction, thrombus, recent and healed Myocardial Infarction. Out of that, 117 (81.8%) were males and 26 (18.2%) were females. Majority of cases of Atherosclerotic coronary artery disease were in the age group 26-33 years which include 35% males and 7% females, followed by 34-40 years which include 27.2% males and 6.3% females, and 18-25 years which include 19.6% males and 4.9% females respectively. While 51 (25.5%) were found to be normal. Out of which 34 were males and 17 were females, majority 27 (52.9%) were in the age group of 18-25 years.

In my study, both age and sex of the individual showed statistically significant relationship with the cardiac pathology mainly atherosclerotic coronary artery disease. As the age increases the chances of having cardiac pathology also increases. Males are having more chances of cardiac pathology mainly atherosclerotic coronary artery disease as compared to females.

According to a report on medical certification of cause of death 2011 by Government of Karnataka, a total of 123221 medically certified deaths were reported in Karnataka state of India in the year 2011. Among them 26987 were young adults of age group 15-44 years, died due to various reasons. Out of them 16773 were male and 10214 were female. It was also seen that total 4499 (12.18%) deaths were due to diseases of circulatory system in age group 15-44 years. Out of them 3081 were male and 1418 were female. Among various cardiac diseases 1127 males and 339 females died due to Ischemic heart diseases.<sup>10</sup>

In a study done by Chugh *et al*<sup>11</sup> in US, they analysed 13 years (1984-1996) of autopsy series of sudden cardiac death and found that women aged 35 to 44 years constituted 32% of all women in the series in contrast to men, who constituted 24% of total male cases. There was a higher proportion of significant coronary artery disease in men compared to women. Most patients had evidence of  $\geq 1$  nonspecific structural cardiac abnormalities like mitral valve prolapse, left ventricular hypertrophy and non-specific myocardial interstitial fibrosis.

In the study by Sanjeet Kumar *et al*<sup>8</sup>, among 43 males, 36 (83.72%) were noted with Atherosclerosis and in 7 females,

atheromatous lesions were found in 4 (57.14%) hearts. Out of which 21 males and 2 females of age group 30-40 years, 18 (85.71%) males and 1(50%) female were affected.

In the study by Abraham Joseph *et al*<sup>9</sup>, in 111 cases aged between 14-35 years 87 (78.3%) cases showed atherosclerotic coronary artery disease. Out of total 95 males cases coronary atherosclerosis was seen in 72 hearts for an overall incidence of 75.8%.

In the study by Dabit Arzamendi *et al*<sup>7</sup>, Of the total 97 individuals who died of sudden cardiac death (SCD), 58 (59.8%) died of Coronary Artery Disease (CAD). In individuals <20 years old, there was no death from CAD. However, CAD became the most important cause of SCD in individuals >20 years old, being responsible for up to 44% of cases. The occurrence of CAD as a cause of SCD increased with age, being 37% in the group of 20 to 30 years old and rising up to 80% in the group of 31 to 40 years old. Among the 185 individuals who died of causes other than CAD, significant CAD was observed in up to 38 (20.5%), evidently without any signs of acute complication.

The high incidence of atherosclerotic coronary artery disease even in relatively younger age group is because of life style changes, smoking cigarettes/beedis, alcohol consumption habits and lack of physical exercise.

As the age progresses the incidence of atherosclerotic coronary artery disease increases. This is because age is also a risk factor of cardiac pathology mainly atherosclerotic coronary artery disease. But in contrast to other studies, in present study we found that age group 26-33 years showed higher number of cases than 18-25 years and 34-40 years age group. This may be explained by the reason that although non modifiable risk factor of atherosclerotic CAD like age is an important factor, modifiable risk factor like habit of smoking and alcohol is more important risk factor than age for atherosclerotic CAD. This is supported by the fact that the frequency of smoking in deceased of 26-33 years was more than 34-40 years age group and alcohol drinking habits were also different among both age groups.

The incidence of atherosclerotic coronary artery disease in females is less than in males both in the present study as well as in all other similar autopsy studies. This is because of the fact that females in the reproductive age group are less prone to atherosclerosis probably attributed to the protective effect of hormones (estrogen) and absence of other risk factors like smoking and alcohol.

In the present study, both frequency and duration of smoking (cigarette/beedi) and alcohol consumption showed statistically significant relationship with cardiac pathology mainly atherosclerotic coronary artery disease. As the frequency and duration of smoking (cigarette/beedi) and alcohol consumption increases the chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases. Though alcohol is supposed to be cardio protective if taken in moderate amount, it shows synergistic effect with other risk factors to promote atherosclerosis in coronaries when the frequency and duration of alcohol consumption increases or associated with smoking.

In the present study, both frequency and duration of tobacco consumption and drugs of abuse did not show any statistically significant relationship with cardiac pathology mainly

atherosclerotic coronary artery disease. However certain drugs like cocaine and cannabis can cause some cardiac pathologies but in this study only few cases gave positive drug history probably because of that there is no statistically significant relationship.

In the present study, we found that there is no statistically significant relationship between type and frequency of physical exercise and cardiac pathology. However lack of physical exercise increases the chances of having cardiac pathology mainly atherosclerotic coronary artery disease. These findings in our study suggest that though moderate physical exercise reduces the chances of having atherosclerotic coronary artery disease but it is not beneficial unless the person stop smoking and reduce alcohol intake. On the other hand vigorous physical exercises can cause various types of cardiomyopathies.

In the present study we found that there is no statistically significant relationship between nutritional supplement intake, regular medication, sport activities and stress with cardiac pathology.

In the present study, history of hypertension, diabetes mellitus and previous heart diseases did not show any statistically significant relationship with the present cardiac pathology.

In the study by Prasad VN *et al*<sup>12</sup>, smoking, alcohol consumption, hypertension and diabetes mellitus showed significant relationship with coronary atherosclerosis.

The reason why the present study did not show statistically significant relationship between hypertension and diabetes mellitus and cardiac pathology could be relatively young age and underdiagnosis.

However in the present study, history of respiratory diseases showed statistically significant relationship with the cardiac pathology.

In the present study, I found that there is a statistically significant relationship between family history of hypertension and cardiac pathology. However family history of diabetes mellitus and heart disease did not show any statistically significant relationship with the cardiac pathology.

Family history of heart disease is an important non modifiable risk factor. However statistically non significant relationship in my study might be because only few cases had positive family history and majority of cases had other more important modifiable risk factors like smoking and alcohol.

In my study, Body Mass Index (BMI) of the individual showed statistically significant relationship with the cardiac pathology mainly atherosclerotic coronary artery disease. As the BMI increases the chances of having cardiac pathology mainly atherosclerotic coronary artery disease increases.

These findings are also supported by the study conducted by Eckart RE *et al*<sup>13</sup>, in America, where age, sex, BMI, hypertension and hyperlipidemia showed statistically significant relationship with the cardiac pathology mainly atherosclerotic coronary artery disease.

In the present study, daily working hours, working days in a week and monthly holidays did not show any statistically significant relationship with the cardiac pathology in case of IT Professionals.

In our study we also found that heart weight increases with body weight, body length and BMI.

## CONCLUSION

In the present study during the study period from November 2013 to May 2015, various risk factors and autopsy findings of total 200 young adults of 18-40 years age, who died due to various reasons like sudden death, hanging, poisoning, burns, electrocution, road traffic accidents etc were studied prospectively. Majority of them were male and from 26-33 years age group.

Majority of cases 71.5% showed underlying Atherosclerotic Coronary Artery Disease of different grades and different extent of luminal narrowing, which also included fixed coronary obstruction, thrombus, recent and healed Myocardial Infarction. Most of them were male belonged to 26-33 years age group.

Other significant cardiac lesions encountered were Pericarditis, Valvular heart disease including Rheumatic heart disease, Arrhythmogenic Right Ventricular Dysplasia, Myocarditis, Concentric Left ventricular hypertrophy, Biventricular hypertrophy, Cardiac Polyp, Anomalous/Aberrant Coronary artery, Hypertrophic cardiomyopathy, Dilated cardiomyopathy, Pancarditis and Coronary artery Vasculitis. In most of the cases these other underlying cardiac pathological lesions were found in association with atherosclerotic coronary artery disease.

Both frequency and duration of smoking (cigarette/beedi) and alcohol consumption, lack of physical exercise, history of respiratory diseases, family history of hypertension, age, sex and BMI showed significant relationship with cardiac pathology mainly atherosclerotic coronary artery disease.

In case of IT Professionals, daily working hours, working days in a week and monthly holidays did not show any statistically significant relationship with the cardiac pathology.

Heart weight was also found to increase with body weight, body length and BMI.

This study emphasizes that, we cannot do anything for non-modifiable risk factors of cardiac pathology mainly atherosclerotic coronary artery disease but we can focus on modifiable risk factors which are more important. So people should stop smoking cigarettes/beedis and reduce the consumption of alcohol, do some sort of moderate physical exercises regularly, focus on the dietary habits to maintain normal weight, check their blood pressure and sugar levels at regular interval and take proper medications. Close family members of the deceased should be counselled about requirement of essential investigations and preventive measures to prevent sudden cardiac death in family members due to inheritable cardiac diseases like atherosclerotic coronary artery disease in future.

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