



Research Article

STUDY OF CARDIAC PATHOLOGY 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. Now because of change in lifestyle and habits, many cardiac pathologies are noticed in comparatively younger age group even in a developing country like India and some of these cardiac pathologies are inheritable. 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 the incidence of various underlying cardiac pathologies in young adults and their epidemiological aspects so that we can counsel the close family members of the deceased to go through essential investigations and take preventive measures in case of inheritable cardiac pathologies. 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. While majority of cases 143 (71.5%) cases showed underlying Atherosclerotic Coronary Artery Disease 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 50 (35%) males and 10 (7%) females. 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%). Atherosclerotic coronary artery disease was the most frequently encountered underlying cardiac pathology even in young adults. Finding 1% cases of arrhythmogenic right ventricular dysplasia (ARVD), in a country like India is very significant and is a matter of concern.

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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. 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.

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Disruption of any element of the heart- myocardium, valves, conduction system, and coronary vasculature can adversely affect pumping efficiency, thus leading to morbidity and mortality.

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.¹

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.²

The mechanism of sudden cardiac death is ventricular fibrillation in 65-85%, ventricular tachycardia in 7-10% and electromechanical dissociation in 20-30%. In children and young adults, in the absence of pre-existing heart disease, non penetrating blunt trauma to the anterior chest wall without excessive force can lead to fatal cardiac arrhythmias and sudden death due to concussion injury (commotio cordis). This entity is being increasingly attributed as the cause of sudden death in healthy young sportspersons.³ Whatever the cause, the cardiac hypertrophy is a substrate for ventricular arrhythmias and sudden cardiac death.⁴

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. Cardiomyopathies account for the second largest number of sudden deaths after coronary artery disease. Among them Dilated cardiomyopathy (DCM) is the most common cause of congestive heart failure.⁵

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.

Arrhythmogenic right ventricular dysplasia, or arrhythmogenic right ventricular cardiomyopathy, is an uncommon form of inheritable disease of the myocardium. It is most commonly associated with right ventricular failure and various rhythm disturbances, particularly ventricular tachycardia or fibrillation. Left-sided involvement with left-sided heart failure may also occur. It is a recognized cause of sudden cardiac death in the young athletes. Morphologically, the right ventricular wall is severely thinned due to loss of myocytes, with extensive fatty infiltration and interstitial fibrosis. Although myocardial inflammation may be present, ARVD/C is not considered an inflammatory cardiomyopathy. Classical ARVD/C has autosomal dominant inheritance with a variable penetrance. The disease has been attributed to defective cell adhesion proteins in the desmosomes that link adjacent cardiac myocyte. *Naxos syndrome* is a disorder characterized by arrhythmogenic right ventricular cardiomyopathy and hyperkeratosis of plantar palmar skin surfaces specifically associated with mutations in the gene encoding the desmosome-associated protein plakoglobin.^{6,7}

The sudden death in apparently healthy young individuals is always a devastating and shocking event. The incidence of sudden deaths in young due to various cardiac pathologies has wide variations in different parts of the world. Very few studies are done in India to know the incidence of various cardiac pathologies in young adults.

Now because of change in lifestyle and habits, many cardiac pathologies are noticed in comparatively younger age group even in a developing country like India and some of these cardiac pathologies are inheritable.

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 the incidence of various underlying cardiac pathologies in young adults and their epidemiological aspects so that we can counsel the close family members of the deceased to go through essential investigations and take preventive measures. In this way we can protect the close family members from fatal inheritable cardiac pathologies.

Aims and Objectives

1. To know the incidence of various cardiac pathologies in young adults dying due to various reasons.
2. To know the epidemiological aspects of cardiac pathology.
3. Counseling the close family members of the deceased about requirement of essential investigations and preventive measures in case of inheritable cardiac pathology in the deceased.

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 etc. 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.

After the analysis, in case of any inheritable cardiac pathology, counselling of close family members of the deceased about requirement of essential investigations and preventive measures was done to prevent sudden cardiac death in family members due to inheritable cardiac diseases in future.

Methodology for data analysis- Data was analyzed using descriptive statistics. 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) and Transgenders.

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, 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-

Table 1 Age-wise distribution of cases (n=200)

Sl. No.	Age (years)	No. of cases	Percentage (%)
1	18 to 25 Years	65	32.5
2	26 to 33 Years	75	37.5
3	34 to 40 Years	60	30
Total		200	100

Majority were in the age group of 26-33 years (37.5%) followed by 18-25 years (32.5%) and 34-40 years (30%) respectively.

Table 2 Sex-wise distribution of cases (n=200)

Sl. No.	Sex	No. of cases	Percentage (%)
1	Male	156	78
2	Female	44	22
3	Transgender	0	0
Total		200	100

The study included 156 (78%) males and 44 (22%) females. There were no transgenders, who died during study period and fulfilled the requirements of inclusion criteria.

Table 3 Age and Sex-wise distribution of cases (n=200)

Sl. No.	Age Groups (Yrs)	Sex		Total
		Male	Female	
1	18 to 25 Years	51 (25.5 %)	14 (7 %)	65 (32.5%)
2	26 to 33 Years	59 (29.5%)	16 (8%)	75 (37.5%)
3	34 to 40 Years	46 (23%)	14 (7%)	60 (30%)
Total		156 (78%)	44 (22%)	200 (100%)

Majority of cases were in the 26-33 years age group which included 59 (29.5%) males and 16 (8%) females followed by 18-25 years age group which included 51 (25.5%) males and 14 (7%) females, and 34-40 years age group which included 46 (23%) males and 14 (7%) females respectively.

Table 4 Distribution of study population based on socio-economic status (n=200)

Sl.no.	Socio-economic status	Number of cases	Percentage (%)
1	Upper Class (I)	18	9
2	Upper Middle Class (II)	83	41.5
3	Lower Middle Class (III)	60	30
4	Upper Lower Class (IV)	35	17.5
5	Lower Class (V)	4	2
Total		200	100

For calculating socio-economic class Modified Kuppaswamy's scale for socio-economic status (monthly family income score modified for 2007) was used. There are 5 classes- Upper (I), Upper-middle (II), Lower-middle (III), Upper-lower (IV), Lower (V).⁸

Majority of cases belonged to Class II (Upper Middle Class- 41.5%) and Class III (Lower Middle Class- 30%) of socio-economic status followed by Class IV, Class I and Class V.

Table 5 Cause of death-wise distribution of study population (n=200)

Sl. No.	Cause of Death	No. of Cases	Percentage (%)
1	Sudden Death	88	44
2	Poisoning	32	16
3	Hanging	20	10
4	Electrocution	17	8.5
5	Natural Death	12	6
6	Snake bite	9	4.5
7	Miscellaneous	22	11

Majority of cases included in the study were Sudden death 88 (44%), followed by Poisoning 32 (16%), Hanging 20 (10%), Electrocution 17 (8.5%), Natural death 12 (6%) and Snake bite 9 (4.5%) respectively. 22 (11%) cases were Miscellaneous which includes road traffic accidents, industrial accidents, fall, drowning, insect bite, assault, burns, pregnancy related deaths and post operative deaths.

Table 6 Incidence of various underlying Cardiac Pathological Lesions

Sl. No.	Cardiac Pathology	No. of Cases	Percentage (%)
1	Atherosclerotic Coronary Artery Disease (including fixed coronary obstruction, thrombus, recent and healed Myocardial Infarction)	143	71.5
	Normal		
2	Pericarditis	51	25.5
3	Valvular Heart Disease	7	3.5
4	Arrhythmogenic Right Ventricular Dysplasia	7	3.5
5	Myocarditis	2	1
6	Concentric Left Ventricular Hypertrophy	4	2
7		4	2

8	Biventricular Hypertrophy	4	2
9	Hypertrophic Cardiomyopathy	1	0.5
10	Dilated Cardiomyopathy	1	0.5
11	Cardiac Polyp	2	1
12	Pancarditis	1	0.5
13	Anomalous Coronary Artery	2	1
14	Coronary Vasculitis	1	0.5

Out of 200 cases 51 (25.5%) were found to be normal. They did not show any significant underlying cardiac pathology grossly and microscopically. While in majority of cases- 143 (71.5%) underlying Atherosclerotic Coronary Artery disease including fixed coronary obstruction, thrombus, recent and healed myocardial infarction was found. 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%). In most of the cases these other underlying cardiac pathological lesions were found in association with atherosclerotic coronary artery disease.

Table 7 Age and Sex distribution of Normal Cases

Sl. No.	Age Groups (Yrs)	Sex		Total
		Male	Female	
1	18 to 25 Years	20 (39.2%)	7 (13.7%)	27 (52.9%)
2	26 to 33 Years	8 (15.7%)	5 (9.8%)	13 (25.5%)
3	34 to 40 Years	6 (11.8%)	5 (9.8%)	11 (21.6%)
	Total	34 (66.7%)	17 (33.3%)	51(100%)

Out of 51 normal cases, majority 27 (52.9%) were in the age group 18-25 years which include 20 (39.2%) males and 7 (13.7%) females, followed by 26-33 years 13 (25.5%) including 8 (15.7%) males and 5 (9.8%) females, and 34-40 years 11 (21.6%) including 6 (11.8%) males and 5 (9.8%) females.

Table 8 Age and Sex Incidence of Atherosclerotic Coronary Artery Disease

Sl. No.	Age Groups (Yrs)	Sex		Total
		Male	Female	
1	18 to 25 Years	28 (19.6%)	7 (4.9%)	35 (24.5%)
2	26 to 33 Years	50 (35%)	10 (7%)	60 (42%)
3	34 to 40 Years	39 (27.2%)	9 (6.3%)	48 (33.5%)
	Total	117 (81.8%)	26 (18.2%)	143 (100%)

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 total 7 cases of valvular heart disease 6 (85.7%) were males and 1 (14.3%) was female. Majority of cases 4 (57.1%) were from 34-40 years age group. Either mitral valve or aortic valve was involved in most of the cases.

Out of total 4 cases of myocarditis, 2 were males and 2 were females. They were diagnosed as viral myocarditis, eosinophilic myocarditis and giant cell myocarditis.

In the present study total 7 (3.5%) cases of pericarditis were found. Out of that 6 were males and one was female. 4 out of total 7 cases were from 34-40 years age group. These cases of pericarditis presented as grey white patches over the surface of heart and most of the cases were associated with atherosclerotic coronary artery disease.

Total 4 (2%) cases showed concentric left ventricular hypertrophy. All 4 cases were male. Out of them 3 belonged to 18-25 years age group. There was no history of hypertension. All heart valves were normal but all 4 cases had associated atherosclerotic coronary artery disease. History of chronic smoking and alcohol consumption was present in 3 cases while in one case history of strenuous exercise at gym was present.

Out of total 4 cases showed biventricular hypertrophy, 3 were males and one was female. One person was 24 year old while other 3 were above 30 years of age. There was no history of hypertension in all cases. Associated atherosclerotic coronary artery disease was seen in all cases. One male was also found to be suffering from chronic kidney disease and he was on regular hemodialysis while the female was also found to be suffering from valvular heart disease (Mitral stenosis). One 24 year old male was chronic smoker and alcoholic. Another 33 year old male was chronic smoker, alcoholic and labourer.

In this study, total 2 (1%) cases showed underlying arrhythmogenic right ventricular dysplasia (ARVD) out of 200 cases. Both were male and belonged to 26-33 years age group. Both males were manual labourer and used to do hard labour.

One case (0.5%) of hypertrophic cardiomyopathy (HCM) was found in a 19 year old male. He was labourer by occupation and had habit of smoking beedis and drinking alcohol. There was asymmetric hypertrophy of interventricular septum. There was no history of hypertension and valvular pathology in this case.

In the present study one case (0.5%) of dilated cardiomyopathy (DCM) was found in an 18 year old male. He was suffering from epilepsy and was regularly taking oxcarbazepine tablets. There was no history of hypertension or any other disease. There was no history of alcohol abuse. Heart valves and coronaries were also normal.

In this study, 2 (1%) cases showed cardiac polyp out of 200 cases. Both were male. One case was diagnosed as fibro-fatty polyp and another case as granulomatous polyp.

In the present study, total 2 (1%) cases in this study showed anomalous coronary artery. Both were male. One 36 year old male showed congenital absence of right coronary artery with single ostium in aorta. Another 30 year old male showed anomalous origin of right coronary artery. Both left and right coronary ostiums were originating from left sinus of valsalva.

In this study one case of pancarditis was found in 21 year old male who died suddenly.

I also observed one case of coronary vasculitis involving Left anterior descending artery in a 22 year old male who died due to dengue fever.

DISCUSSION

Cardiovascular disease is now the most common cause of death worldwide.⁹ The causes of sudden cardiac death differ greatly among various age groups. Because of change in lifestyle and habits, occurrence of many cardiac pathologies in

comparatively younger age group even in a developing country like India, is a matter of concern.

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 I 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 the incidence of various underlying cardiac pathologies in young adults and epidemiological aspects so that we can counsel the close family members of the deceased to go through essential investigations and take preventive measures in case of inheritable cardiac pathologies. 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. Majority were in the age group of 26-33 years 75 (37.5%) cases followed by 18-25 years 65 (32.5%) cases out of total 200 cases. Total 156 (78%) were males and 44 (22%) were females.

In the study by Dabit Arzamendi *et al*¹⁰, in 243 cases of <40 years age, majority 146 cases were in 31-40 years age group. Study by Sanjeet Kumar *et al*¹¹, 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*¹², 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, for calculating socio-economic class Modified Kuppaswamy's scale for socio-economic status (monthly family income score modified for 2007) was used and majority of cases belonged to Class II (Upper Middle Class- 41.5%) and Class III (Lower Middle Class- 30%) of socio-economic status.

In the present study, majority of cases included were Sudden death 88 (44%), followed by Poisoning 32 (16%), Hanging 20 (10%), Electrocution 17 (8.5%), Natural death 12 (6%) etc.

In the study by Dabit Arzamendi *et al*¹⁰, out of 243 cases, 97 (39.9%) cases were sudden cardiac death.

In the present study, out of 200 cases, 51 (25.5%) were found to be normal. There was no significant underlying cardiac pathology grossly and microscopically. Out of 51 normal cases, 34 were males and 17 were females, majority 27 (52.9%) were in the age group 18-25 years which include 20 (39.2%) males and 7 (13.7%) females.

In the study by Sanjeet Kumar *et al*¹¹, among 43 males, heart of 7 (16.28%) males were normal and in 7 females, heart of 3 (42.86%) females were normal. In 30-40 years age group, out of 21 males and 2 females, heart of 3 males and 1 female were normal. In 41-50 years age group, out of 13 males and 4 females, heart of 3 males and 2 females were normal. In 51-60

years age group, out of 9 males and 1 female, heart of 1 male was normal.

As the age is progressing the normal cases are decreasing. This is because age is also a risk factor of cardiac pathology mainly atherosclerotic coronary artery disease.

In the present study, out of total 200 cases, majority of cases 143 (71.5%) cases showed underlying Atherosclerotic Coronary Artery Disease 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 60 (42%) of Atherosclerotic coronary artery disease were in the age group 26-33 years followed by 34-40 years 48 (33.5%) cases and 18-25 years 35 (24.5%) cases.

In the study by Sanjeet Kumar *et al*¹¹, 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*¹², 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*¹⁰, 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, total 7 (3.5%) cases showed valvular heart disease out of 200 cases. Out of that 6 (85.7%) were males and 1 (14.3%) was female. Majority of cases 4 (57.1%) were from 34-40 years age group. I also found total 4 (2%) cases of myocarditis. Among that 2 were males and 2 were females.

In the study by Zheng ZJ *et al*², among 15-34 years age group 2.5% cases showed Rheumatic heart disease and 7.2% cases showed carditis and non-rheumatic valvular heart disease among out of hospital cardiac death victims. Females were involved more than the males.

In a study by Eckart RE *et al*¹³, in America, over a period of 10 years, in 902 cases of adjudicated unanticipated sudden cardiac death, they found that out of total 298 cases of <35 years of age myocarditis was seen in 17 (5.7%) cases while out of 604 cases of age ≥ 35 years myocarditis was seen in 13 (2.2%) cases.

In the present study total 7 (3.5%) cases of pericarditis were found. Out of that 6 were males and one was female. 4 out of total 7 cases were from 34-40 years age group.

In the present study, total 4 (2%) cases showed concentric left ventricular hypertrophy. All 4 cases were male. Out of them 3 belonged to 18-25 years age group.

In the present study, total 4 (2%) cases showed biventricular hypertrophy. Out of that 3 were males and one was female. One person was 24 year old while other 3 were above 30 years of age.

Whatever the cause, cardiac hypertrophy is a substrate for ventricular arrhythmia and sudden cardiac death.

In the present study, total 2 (1%) cases showed underlying arrhythmogenic right ventricular dysplasia (ARVD) out of 200 cases. Both were male and belonged to 26-33 years age group.

In a study by Eckart RE *et al*¹³, in America, over a period of 10 years, in 902 cases of adjudicated unanticipated sudden cardiac death, they found that out of total 298 cases of <35 years of age arrhythmogenic right ventricular dysplasia was seen in 4 (1.3%) cases while out of 604 cases of age ≥ 35 years ARVD was seen in 6 (1%) cases.

In both the studies incidence of ARVD correlate each other. This is the cause of concern because finding ARVD to the extent of 1% in a country like India is very significant.

In the present study, one case (0.5%) of hypertrophic cardiomyopathy (HCM) was found in a 19 year old male.

In a study by Eckart RE *et al*¹³, in America, over a period of 10 years, in 902 cases of adjudicated unanticipated sudden cardiac death, they found that out of total 298 cases of <35 years of age hypertrophic cardiomyopathy was seen in 38 (12.8%) cases while out of 604 cases of age ≥ 35 years HCM was seen in 19 (3.1%) cases.

Alessandra Doolan *et al*¹⁴ did a study in Australia between 1994 and 2002 to know the cause of sudden cardiac deaths in young Australians aged ≤ 35 years. She found hypertrophic cardiomyopathy/ unexplained left ventricular hypertrophy in 15% cases.

In the present study one case (0.5%) of dilated cardiomyopathy (DCM) was found in an 18 year old male.

In the study conducted by Eckart RE *et al*¹³, in America, over a period of 10 years, in 902 cases of adjudicated unanticipated sudden cardiac death, they found that out of total 298 cases of <35 years of age idiopathic dilated cardiomyopathy (DCM) was seen in 14 (4.7%) cases while out of 604 cases of age ≥ 35 years DCM was seen in 21 (3.5%) cases.

All these study show that incidence of cardiomyopathies is more in younger age group (age < 35 years). However in contrast to other studies, the present study is showing less incidence of hypertrophic and dilated cardiomyopathy in India. This might be because of difference in life style, habits and genetic makeup of individuals in Western countries and India.

In my study, 2 (1%) cases showed cardiac polyp out of 200 cases. Both were male.

In the present study, total 2 (1%) cases in this study showed anomalous coronary artery. Both were male.

In the study conducted by Eckart RE *et al*¹³, in America, over a period of 10 years, in 902 cases of adjudicated unanticipated sudden cardiac death, they found that out of total 298 cases of <35 years of age anomalous coronary artery was seen in 12 (4%) cases while out of 604 cases of age ≥ 35 years, 1 (0.2%) cases showed anomalous coronary artery.

In my study one case of pancarditis was found in 21 year old male who died suddenly.

I also observed one case of coronary vasculitis involving Left anterior descending artery in a 22 year old male who died due to dengue fever.

After the analysis, in case of any inheritable cardiac pathology, close family members of the deceased were counselled about requirement of essential investigations and preventive measures to prevent sudden cardiac death in family members due to inheritable cardiac diseases in future.

CONCLUSION

In the present study during the study period from November 2013 to May 2015, 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 belonged to Class II (Upper Middle Class) socio-economic class according to Modified Kuppaswamy's scale for socio-economic status (monthly family income score modified for 2007). About 25.5% individuals did not show any significant underlying cardiac pathology grossly and microscopically. While majority of cases 71.5% showed underlying Atherosclerotic Coronary Artery Disease 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.

Finding 1% cases of arrhythmogenic right ventricular dysplasia (ARVD), in a country like India is very significant and is a matter of concern.

Before undergoing any surgery proper cardiac evaluation with basic investigations like ECG and Echocardiography should be done to detect underlying cardiac pathology to prevent sudden cardiac deaths. As many cardiac pathologies like arrhythmogenic right ventricular dysplasia (ARVD) gets precipitated even by the injections of local anaesthetics and may lead to sudden death.

This study emphasizes that, 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 in future.

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References

1. Schoen FJ, Mitchell RN. The heart. In: Kumar V, Abbas AK, Aster JC, editors. Robbins and Cotran pathologic basis of disease. South Asia ed. Elsevier; 2015. p. 523,551. (vol 1).
2. Zheng ZJ, Croft JB, Giles WH, Mensah A. Out-of-hospital cardiac deaths in adolescents and young adults in the United States, 1989 to 1998. *Am J Prev Med* 2005;29(5 suppl 1):36-41.

3. Kasthuri AS, Handa A, Niyogi M, Choudhury JC. Sudden death: A clinicopathological study. *J Assoc Physicians India* 2002;50:551-553.
4. Finkbeiner WE, Ursell PC, Davis RL. Autopsy pathology: a manual and atlas. 2nd ed. Saunders Elsevier; 2009. p. 97.
5. Saukko P, Knight B. Knight's forensic pathology. 3rd ed. UK: Hodder Arnold (publishers)Ltd; 2004. p. 493,507.
6. Schoen FJ, Mitchell RN. The heart. In: Kumar V, Abbas AK, Aster JC, editors. Robbins and Cotran pathologic basis of disease. South Asia ed. Elsevier; 2015. p. 568. (vol 1).
7. Fuster V, O'Rourke RA, Walsh RA, Wilson PP. Hurst's the heart. 12th ed. New York: McGraw Hill; 2007. p. 797. (vol 1).
8. Park K. Park's textbook of preventive and social medicine. 23rd ed. Banarsidas Bhanot Publishers; 2015. p. 690.
9. Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J. Harrison's principles of internal medicine. 18th ed. USA: Mc Graw-Hill Companies Inc; 2012. p.1811. (vol 2).
10. Arzamendi D, Benito B, Marcos HT, Flores J, Tanguay JF, Ly H *et al*. Increase in sudden death from coronary artery disease in young adults. *Am Heart J* 2011;161(3):574-580.
11. Kumar S, Verma AK, Kumar N, Verma RK. Prevalence of coronary atherosclerosis in different age groups: a post-mortem study. *Biomedical Research* 2013;24(1):139-141.
12. Joseph A, Ackerman D, Talley JD, Johnstone J, Kupersmith J. Manifestations of coronary atherosclerosis in young trauma victims- an autopsy study. *J Am Coll Cardiol* 1993;22(2):459-67.
13. Eckart RE, Shry EA, Burke AP, McNear JA, Appel DA, Rojas LMC *et al*. Sudden death in young adults- an autopsy based series of a population undergoing active surveillance. *J Am Coll Cardiol* 2011;58(12):1254-61.
14. Doolan A, Semsarian C, Langlois N. Causes of sudden cardiac death in young Australians. *Med J Aust* 2004;180(3):110-112.

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