

CARDIOVASCULAR CAUSES OF SUDDEN DEATH- AN AUTOPSY STUDY

Deepu Thankappan¹, Zachariah Thomas²

¹Assistant Professor, Department of Forensic Medicine, Al-Azhar Medical College, Thodupuzha, Kerala.

²Professor, Department of Forensic Medicine, Government Medical College, Idukki, Kerala.

ABSTRACT

BACKGROUND

Present study "Cardiovascular Causes of Sudden Death- An Autopsy Study" was a cross-sectional study conducted in Department of Forensic Medicine, Government Medical College, Kottayam, during the time period from June 1st 2013 to June 1st 2014. The objective of the study was to find out the cardiovascular causes of sudden deaths and to correlate the postmortem findings with the histopathological examination. 57 cases brought for postmortem examination with history suggestive of sudden natural death were taken into the study and those cases observed to have a cardiovascular cause of sudden death during autopsy were further examined and their heart specimens were subjected to histopathological examination. Then, the sociodemographic factors, postmortem findings and histopathological findings were correlated and analysed.

MATERIALS AND METHODS

57 cases brought for autopsy at Department of Forensic Medicine, Government Medical College, Kottayam from 01.06.2013 to 31.05.2014 were autopsied and subjected to histopathological examination of the heart. The socio-demographic data were collected; they were analyzed and correlated with the postmortem and histopathological findings.

RESULTS

Out of the 57 subjects who were taken into the study, maximum number of Sudden natural deaths were in the 36-50 year age group (42.2%), 33.3% in the 51-65 year age group and 14% of cases were in the 66-80 year age group.

CONCLUSION

Histopathological examination of the samples showed myocardial infarction in 33.3% of cases; chronic ischaemic heart disease in 56.1% of cases and myocarditis in 19.3% of cases. The major cardiovascular cause of sudden death was ascertained as Coronary artery disease.

KEYWORDS

Sudden death; Cardiovascular; coronary artery; myocardial infarction; atherosclerosis; Autopsy; histopathological examination.

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BACKGROUND

AIMS AND OBJECTIVES

1. To find out the cardiovascular causes of death, among those sudden death victims who are brought for medicolegal postmortem examination to Department of Forensic Medicine, Government Medical College, Kottayam.
2. To assess sociodemographic factors among the above subjects.
3. To analyse the postmortem examination and histopathology findings among the above group.

Sudden unexpected natural death cases in adults are steadily increasing world over and is an issue of great concern for medical professionals.¹ Sudden death especially

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Corresponding Author:

*Dr. Zachariah Thomas,
Professor, Department of Forensic Medicine,
Government Medical College,
Idukki-685602, Kerala.*

E-mail: zachtom24@yahoo.com

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of a young and apparently healthy adult is not only shocking, but also has profound impact on the psyche of the society.² Most of the sudden deaths occur outside the hospitals and in the emergency rooms reflecting their unexpected character.³ Present study "Cardiovascular Causes of Sudden Death- An Autopsy Study" was a cross-sectional study conducted in Department of Forensic Medicine, Government Medical College, Kottayam, Kerala, during the time period from June 1st 2013 to June 1st 2014. The objective of the study was to find out the cardiovascular causes of sudden deaths and to correlate the postmortem findings with the histopathological examination.

The prime goal of a medicolegal autopsy is to determine cause of death and these autopsies have an important role to play in garnering important epidemiological data.^[4,5]

As per the Indian law, all cases of sudden unexpected deaths or deaths in which the cause of death was not diagnosed or ascertained by the doctor should be subjected to medicolegal autopsy.⁶ The gold standard for confirming absence or presence of a structural abnormality is histopathological examination of the patient's heart.⁷

Death is said to be sudden when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness (WHO).⁸ Sudden natural death accounts for approximately 10% of all deaths.⁹ Sudden cardiac death is commonly defined as an unexpected natural death due to cardiac causes.¹⁰ Diseases of cardiovascular system accounts for 45 to 50% of all sudden deaths.¹¹

The most common underlying pathologic conditions in children and adolescents are myocarditis, hypertrophic cardiomyopathy, congenital coronary artery anomalies, atherosclerotic coronary artery disease, conduction system abnormalities, mitral valve prolapse and aortic dissection. In adults, coronary atherosclerosis and acquired forms of cardiomyopathy are the most common findings in autopsies.¹⁰

As indicated earlier, at least 80% of patients who experience sudden cardiac death have coronary artery disease as the underlying anatomic substrate due to atherosclerotic changes of the coronary arteries. Non-atherosclerotic coronary artery abnormalities are important in only a very small number of sudden cardiac deaths and include problems such as coronary arteritis, embolism, dissection and congenital malformations of anomalous origin of a left coronary artery from the pulmonary artery or of a left coronary artery from the right or non-coronary aortic sinus of Valsalva passing between the aortic and pulmonary artery roots.¹⁰

Left ventricular failure and cardiogenic shock is the most feared complication of acute myocardial infarction. It is likely to occur if the infarcted area exceeds 40% of left ventricle and mortality is up to 90%. Myocardial rupture may occur most commonly between first and fourth day of myocardial infarction. Arrhythmias usually accounts from half of deaths from ischaemic heart diseases; maybe due to increased sympathetic activity mediated by increased level of local or circulating catecholamines. Left ventricular aneurysms complicate 10 to 15% of healed transmural myocardial infarcts.¹²

The valvular lesions like aortic stenosis, aortic regurgitation, mitral stenosis, rupture of the chordae and ball valve thrombus may also result in sudden cardiac death. Acute pericarditis, acute myocarditis and acute endocarditis are not uncommon causes of sudden cardiac death.¹¹

Patients with primary electrophysiological abnormalities represent a group in whom mechanical function of the myocardium is normal and an electrophysiological derangement represents the primary cardiac problem. This includes patients with the congenital long-QT syndrome, Wolff-Parkinson-White syndrome, several types of distinctive ventricular tachycardias, Brugada's syndrome, etc. Antiarrhythmic drugs have long been known to be capable of provoking ventricular tachyarrhythmias and sudden cardiac death.¹⁰

Age, hypertension, left ventricular hypertrophy, intraventricular conduction block, elevated serum cholesterol, glucose intolerance, decreased vital capacity, smoking, relative weight and heart rate identify individuals

at risk for sudden cardiac death. Smoking is an important risk factor. In the Framingham study, the annual incidence of sudden cardiac deaths increased from 13 per 1000 in nonsmokers to almost 2.5 times that for people who smoked >20 cigarettes per day.¹⁰

History can provide clues to the high-risk patient. The number of sudden deaths is increasing to a great extent these days due to many risk factors like lifestyle, fast food culture, addictions like smoking and alcoholism, sedentary lifestyles and occupation, etc.¹³

Arteriosclerosis literally means "hardening of the arteries"; it is a generic term reflecting arterial wall thickening and loss of elasticity. Three lesions under the term arteriosclerosis:

1. Atherosclerosis,
2. Monckeberg medial calcific sclerosis, and
3. Arteriolosclerosis.



Figure 1. Left Ventricular Aneurysm with Mural Thrombus



Figure 2. Coronary Artery Stenosis



Figure 3. Rupture of Aortic Dissection

MATERIALS AND METHODS

57 cases brought for autopsy at Department of Forensic Medicine, Government Medical College, Kottayam, from June 01, 2013, to May 31, 2014, were autopsied and subjected to histopathological examination of the heart. The sociodemographic data were collected; they were analysed and correlated with the postmortem and histopathological findings.

Inclusion Criteria

Known cases of sudden natural death brought for medicolegal autopsy.

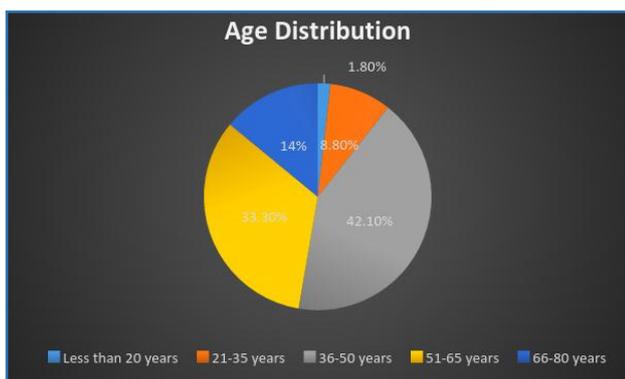
Exclusion Criteria

Unknown cases, decomposed body.

DISCUSSION OF RESULTS

Distribution of age among the study group

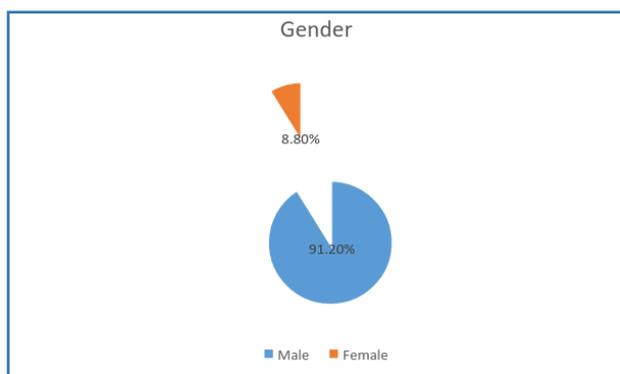
Out of the 57 subjects who were taken into the study, maximum number of sudden natural deaths were in the 36-50 year age group (42.2%), 33.3% in the 51-65 year age group and 14% of cases were in the 66-80 year age group. The youngest age to participate in the study was 15 years, the eldest was 78 years and the mean age was 50.63 years.



Graph 1. Age Distribution of the Study Sample

Distribution of Gender among the Study Group

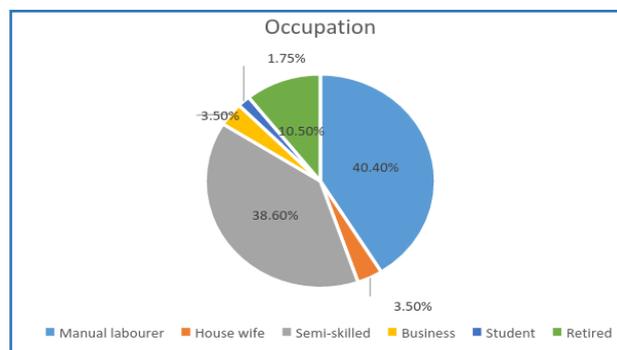
A total of 57 autopsy cases were taken into the study; of which 52 were males (91.2%) and 5 were females (8.8%). The male-to-female predisposition ratio is 10.4:1.



Graph 2. Distribution of Gender

Distribution of Occupation among the Study Group

When the study sample was looked into by occupation, it was seen that manual labourers were the major group- 40.4%, followed by semi-skilled workers- 38.6%, business men were 3.5%, others- 12.2% and one among the study group was a student- 1.75%.



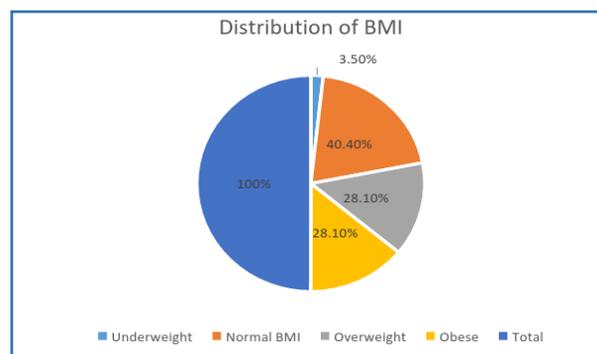
Graph 3. Distribution of Occupation Among Study Subjects

Distribution of Sample According to Body Mass Index (BMI)

Study sample was grouped into 4 according to the BMI. They were:

1. BMI <18.5 (underweight).
2. BMI 18.5-22.99 (normal).
3. BMI 23-24.99 (overweight).
4. BMI 25 and above (obese).

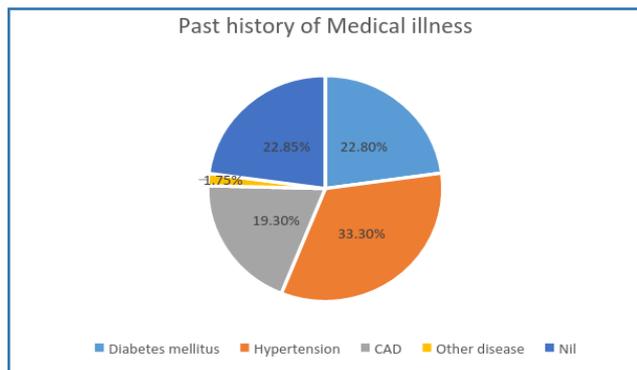
Majority of the study sample were in the normal BMI group- 40.40%, overweight and obese groups showed equal distribution- 28.1%. Underweight were only 3.5%.



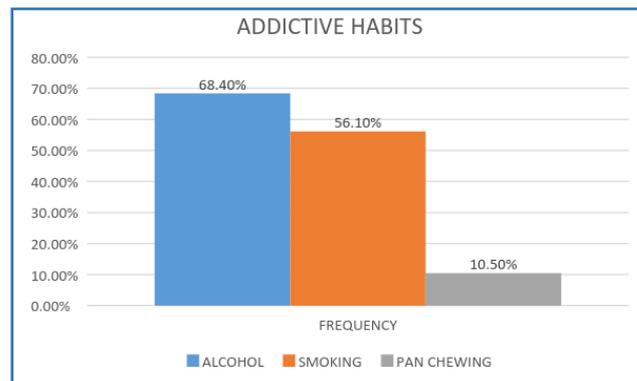
Graph 4. Distribution of BMI Among Study Population

Past History of Illness

Of the total 57 cases, 13 had suffered from diabetes (22.8%), 19 had suffered from systemic hypertension (33.3%), 11 had history of coronary artery disease (19.3%) and one person had past history of bronchial asthma (1.75%).



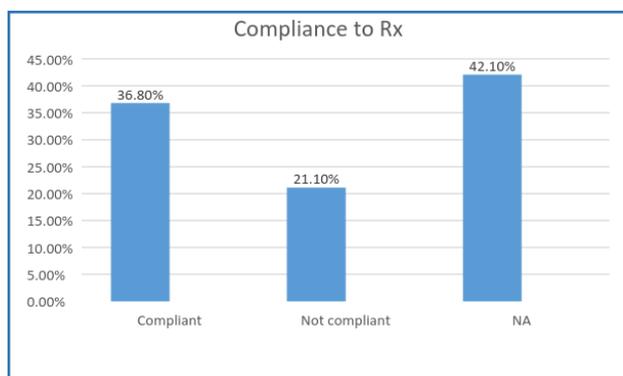
Graph 5. Distribution of Medical Illness in the Past History



Graph 7. Distribution of Addictive Habits

Compliance to Treatment

57.9% cases gave history of treatment for lifestyle diseases of which 36.8% were compliant to the treatment and 21.1% were not.



Graph 6. Distribution of Compliance to Treatment

Distribution of Addictive Habits

Addictive habits like alcoholism and smoking had been prevalent in the sudden cardiovascular death cases. 68.4% gave history of alcoholism, 56.1% were smokers and 10.5% were pan chewers. 46.8% of subjects gave history of both alcoholism and smoking. No history of drug addiction was obtained.

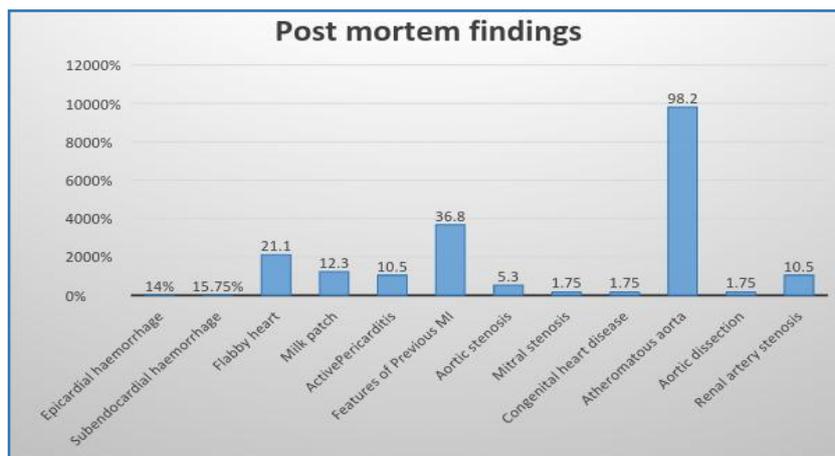
Postmortem Findings

While doing dissection of the heart, the macroscopic findings we recorded were: weight of the heart, wall thickness of ventricles, flabbiness of heart, epicardial and subendocardial haemorrhages, pale and haemorrhagic areas in myocardium with or without softening. Features of previous myocardial infarction, milk patches, pericarditis, atherosclerotic involvement of coronary vessels, aorta and renal arteries, valvular diseases and aortic dissection were searched for and recorded.

The lowest weight of the heart in the study group was 250 grams, the highest was 840 grams and the mean weight of the heart was 371.84 grams, which is well above the normal. Of the 57 cases of sudden cardiovascular deaths, 8 showed epicardial haemorrhages (14%); heart was flabby in 12 cases (21.1%) and subendocardial haemorrhage was present in 9 cases (15.8%). Active pericarditis was noted in 10.5% while milk patches were seen in 12.35%.

On analysis of sequelae following myocardial infarction; 36.8% of cases had endomyocardial fibrosis and cardiac aneurysms. Evidence of valvular heart diseases leading to sudden death, i.e. aortic valve stenosis (3.5%) and mitral valve stenosis (1.75%) was also present. There was one case of congenital heart disease and it was ventricular septal defect (1.75%).

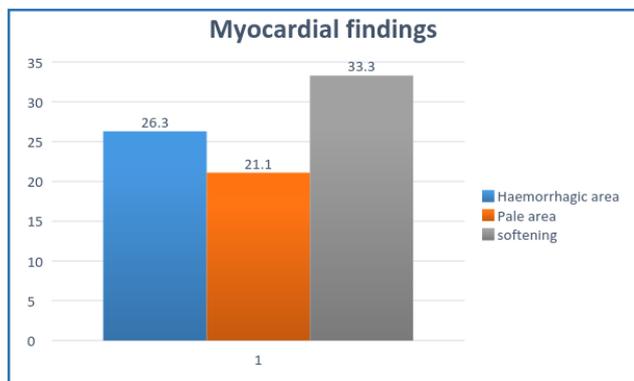
Aortic dissection was the cause of death in one case (1.75%). Intimal layer of aorta showed atherosclerotic plaques in almost all cases (98.2%) and renal artery stenosis was present in 10.5% cases.



Graph 8. Distribution of Postmortem Findings among Study Samples

Left ventricular hypertrophy is said to be present when the left ventricular wall thickness is increased above 15 mm and right ventricle is hypertrophied when its thickness is more than 5 mm. Left ventricular wall thickness was increased in 82.5% cases, while it was normal in 17.5%. Right ventricular wall thickness was increased in 65% cases and it was normal in 35%.

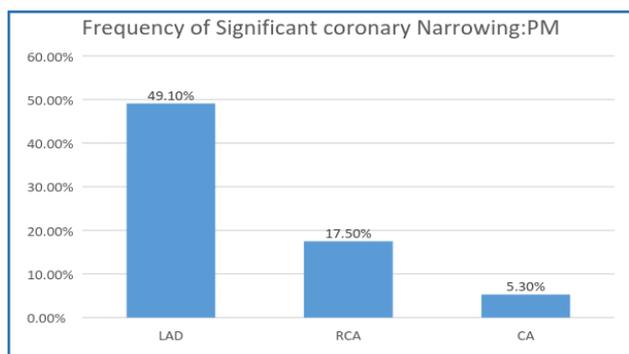
Left ventricular myocardium showed haemorrhagic areas in 26.3% cases, pale areas in 21.1% of cases and associated softening of the myocardium in 33.3% of cases.



Graph 9. Distribution of Myocardial Findings

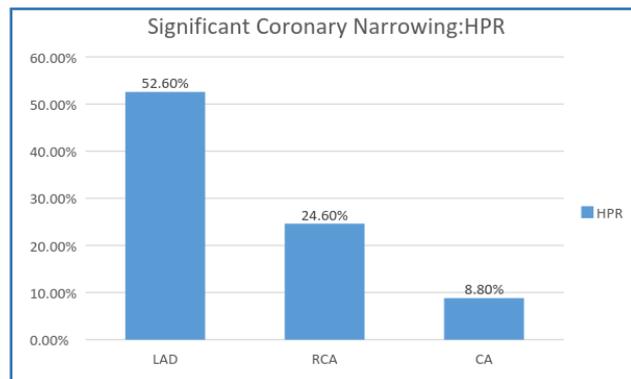
Distribution of Coronary Artery Narrowing

On postmortem examination of the heart, significant coronary narrowing (75% and above) of anterior descending branch of Left Coronary Artery (LCA) was seen in 49.1% cases, that of Right Coronary Artery (RCA) in 17.5% of cases and that of circumflex artery in 5.3% of cases. Coronary artery lumen narrowing along with calcification was seen in 31.5%.



Graph 10. Distribution of the Finding of Coronary Artery Stenosis in Histopathology

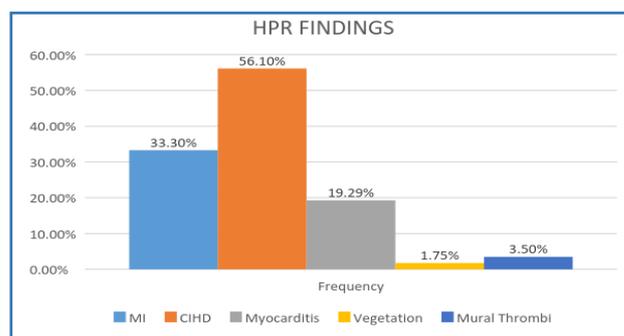
In histopathological examination of coronary artery sections, 52.6% showed significant narrowing of LAD, 24.6% showed significant narrowing of RCA and 8.8% showed significant narrowing of circumflex artery.



Graph 11. Distribution of Significant Narrowing among Coronary Arteries on Histopathological Examination

Distribution of the Myocardial Findings on Histopathology

From the sections of myocardium, evidence of myocardial infarction was noticed in 33.3% cases; evidence of Chronic Ischaemic Heart Disease (CIHD) was seen in 56.1% cases and endomyocardial fibrosis was seen in 45.6% of cases. There was evidence of myocarditis in 19.29% of cases on histopathological examination. One case showed valvular vegetation (1.75%) and mural thrombi was seen adherent to the endocardial in 2 cases (3.5%).



Graph 12. Distribution of the Histopathological Findings among the Study Samples

CONCLUSION

Following conclusions could be drawn out of the Study

1. The incidence of sudden natural deaths due to cardiovascular causes was the highest in the age group 36-50 years and there was strong male predisposition (male:female - 10.4:1).
2. Majority of the study subjects were manual labourers (40.4%) and most of the cases were having normal BMI (40.4%).
3. Co-morbidities like hypertension and diabetes mellitus; and addictive habits like smoking and alcoholism were prevalent in the study population.
4. There was left ventricular hypertrophy in 82.5% of cases, which is a known risk factor for ischaemic heart disease.

5. Significant narrowing of the coronary arteries was observed; the major artery to get affected was the anterior descending branch of left coronary artery in 49.1% of cases.
6. Histopathological examination of the samples showed myocardial infarction in 33.3% of cases; chronic ischaemic heart disease in 56.1% of cases and myocarditis in 19.3% of cases. The major cardiovascular cause of sudden death was ascertained as coronary artery disease.

LIMITATIONS

1. Availability of special stains like triphenyl tetrazolium chloride could have enhanced the histopathological diagnostic technique; especially, in cases of early myocardial infarction.
2. Findings in this study cannot be projected as true incidence rate in the community because of the small sample size owing to limited time. However, the findings worked out in the current study are definitely generalisable to the common population as crude indicators of the disease magnitude.

RECOMMENDATIONS

In our study, the incidence of sudden natural death was seen prevalent in the age group 36-50 years with a clear and massive male predisposition. Hence, we think, regular medical examinations and screening for risk factors of ischaemic heart disease are needed from 35 years of age onwards especially in males. Also, the incidence of cardiovascular sudden deaths was observed the maximum among the manual labourers. This might be due to delay in the early diagnosis and lack of regular and good quality medical care owing to socioeconomic factors. Hence, we suggest that the awareness programmes about the noncommunicable diseases need to be strengthened in peripheral setups. Known risk factors of coronary heart diseases like diabetes mellitus and hypertension were prevalent among the sudden death victims. Proper control of the lifestyle diseases is essential to arrest the progression of coronary atherosclerosis process. Addictive habits like alcohol and tobacco abuse were very prevalent among the study population, which strongly recommends the abandoning of such habits.

The incidence of myocarditis was 19.3%. While conducting the medicolegal autopsy in sudden deaths, it is good to keep in mind about the nonstructural heart diseases like myocarditis. We have observed an association between the epicardial haemorrhages and flabbiness of heart with

myocarditis. Histopathology of the heart is very helpful to the forensic surgeons in arriving at a conclusion regarding the cause of death in sudden deaths particularly in cases like nonstructural heart diseases.

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