Original Research Article

A study to find out correlation between life style, nutritional status, personnel habits, physical development and sudden death due to cardiac origin

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ABSTRACT

Present study was carried out on sudden death cases brought to the institute either as brought dead or died during treatment with 24 hours of admission and forwarded by the investigating officer for medico-legal postmortem examination. Various parameters were collected such as age, length and weight of the body, history of chest pain, vomiting etc. Out of 61 deceased examined, 50 were male and 11 were female. Commonest age group was 46 – 55 years followed by 36 -45 and 56 – 65 years of age. Vegetarians (50) and tobacco chewing (47) outnumber the all other causes. Individuals are having indoor working place (44) are more affected than the outdoor workers (17). Commonly affected individuals were having body weight between 61 -70 kg (Mean 65.5 kg) and body length 160-169 cm (Mean 164.5cm). There is no correlation was observed between the sudden death and BMI. Left coronary artery affected more as compared to right one. The histopathological examination revealed positive result in 35 cases (57%) out of which, acute myocardial infarction in 13 cases and in 22 cases presence of healed myocardial infarction while in 26 cases there was no changes observed.

1. Introduction

Sudden death is defined as a natural, unexpected fatal event within one hour of the beginning of symptoms in apparently healthy subject.[1] or one whose disease was not so severe enough as to predict such an abrupt outcome.[2] Some consider death within 24 hours of onset of events. In the present era of modernization and new inventions, there are changes in life styles, eating habits, increasing comfort at working environment, leading to less physical activity. Due to changes at social, economical and cultural level there are increase stress factors especially in middle economic group make them prone to many cardiovascular complications and sudden deaths in early age.

In natural death, the death due to cardiac disease is the most common cause of an unexpected sudden death in all age groups commonly in people aged 30 or over, while non cardiac conditions such as acute respiratory arrest, choking or asphyxiation, toxicity or poisoning, anaphylaxis, or trauma.[3] Coronary artery disease is one of the most common causes of sudden death and it is increasing day by day. It is sometimes called "The Captain of the Men's death" and it constitutes a significant portion of the deaths attended by clinicians as well as at autopsies observed by Forensic experts in our country. Coronary heart disease (CHD) is the leading cause of death in India as well as worldwide. Previously it was considered a disease of primarily high-income countries but now leads to more deaths and disability in low and middle-income countries, such as India, with death rates that are increasing disproportionately compared to high-income countries. It affects people at younger ages in low and middle income countries, compared to high-income countries, thereby having a greater economic impact on low- and middle income countries.[4]

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Though these deaths are natural, they carry medico-legal importance because these deaths occur in persons who have been apparently healthy, without any diagnosed disease that can be attributed to the cause of death or, the period of illness before the supervening of death is so short that the disease cannot be diagnosed so early.[3,4] Gross and microscopic appearance of an infarct at autopsy depends on the duration of survival of the patient following the events of myocardial infarction.[4]

1.1. Economic burden of CHD in india

India is estimated to have lost 8.7 billion 1998 international dollars in 2005 because of CHD, stroke, and diabetes. These estimates increase to 54 billion 1998 international dollars by 2015. India's growth of gross domestic product (GDP) is estimated to fall by 1% because of the combined economic impact of CHD, stroke, and diabetes (WHO, 2005). A 2000 estimate of 9.2 million productive years of lives lost in Indian adults secondary to overall CVD contributing to this economic decline. As CHD (and CVD) rates increase, this estimate increases to 17.9 million by 2030 (Leader).[5] Effective screening, evaluation, and management strategies for CHD are well-established in high-income countries, but these strategies have not been fully implemented in India. Ischemic heart disease globally is the most common form of heart disease, the cause of myocardial infarction and the most common cause of death.[6] Tobacco products are widely consumed as smoking and smokeless tobacco (SLT). The consumption of smokeless tobacco may effects of nicotine and tobacco-specific N-nitrosamines. They generally consume the most commonly available SLT products like local made or refinedgutkha and khaini8-10 times per day. There was a strong correlation of nicotine with reactive oxygen species (ROS), reactive nitrogen species (RNS), cholesterol, and creatinine in exposed smokeless tobacco (gutkha) consumers. These data demonstrate SLT users are at high cardiovascular risk due to nicotine-induced free radicals and oxidative damage.[7] Histopathological examination of the heart is very important tool to come to definitive opinion regarding the presence of infarction at autopsy. On gross examination the infarct is not identifiable within the first 12 hours but under the microscopic examination the area of myocardial infarction presents as a circumscribed area of ischemic, coagulative necrosis (cell death).[5,8] Standard antemortem diagnostic criteria:As per the revised WHO criteria in 2000[9] for the diagnosis of myocardial infarction the following parameters are to be met with:

1. Typical clinical symptoms
2. Pathological Q waves
3. ST elevation or depression or coronary intervention along with
4. Increased serum cardiac Troponin levels

Looking into the magnitude of the involvement of heart in sudden death cases and considering the importance of cause of death both in criminal investigation and to establish the death due to cardiac origin present the study was carried out to find out any correlation between the life style, nutritional status, personnel habits, physical development and sudden death due to cardiac origin.
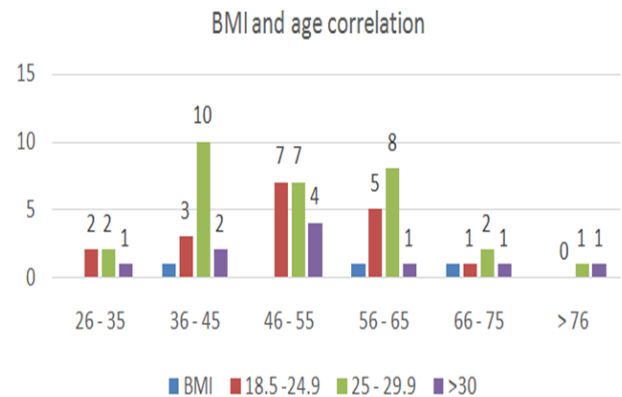

Fig. 1: Comparison between body mass index and age

2. Materials and Methods

The present study was carried on the deceased which were brought for medico legal postmortem examination by investigating officer on the deceased either brought dead from outside or who died during the treatment within 24 hours of admission having history of chest pain, perspiration, vomiting and unconsciousness or previous history of coronary artery disease. The personal data were collected by interview with the patients relatives or police officer or from the available treatment case papers. To find out the cause of death in these cases, as per the institutional policy, medico-legal postmortem examination was carried. Based on the following criteria the deceased were selected:

2.1. Inclusion criteria

1. Age above 20 years
2. Both genders
3. Death within 24 hours with no definitive cause of death
4. Deceased having previous history of coronary artery disease

2.2. Exclusion criteria

1. Age below 20 years
2. Deceased with definitive cause of death
3. Injuries over heart
4. Unidentified deceased

2.3. Post mortem examination

Personal data were collected by interview with nearest relative about his /her condition, previous disease, any complications, procedure and treatment etc. external examination performed after taking weight, and length of the deceased. Internal examination was performed by opening chest cavity the heart was separated from its attachments and pericardial sac. Gross observations were made after cleaning thoroughly in tap water to remove clots and then weight the organ and observe for presence of any gross abnormalities like pale area, thickening of vessels or hardening of vessels, thinning or thickening of ventricular walls etc.The heart was cut into slices about 5 -10 mm thick with the help of a long knife from the apex upward till the bicuspid and tricuspid valves. The cut surfaces were examined for any signs of ischemia like loss of moist luster, mottling, mottling with yellow tan infarct, yellow tan softening, red-gray depressed, infarct borders, or scarring. Gross examination of the coronaries was carried by cutting serial sections transversely at 3 – 4 mm intervals and noted for the degree of stenosis, atheroma, presence of calcification and thrombus in the left main trunk, the left circumflex, the anterior descending, right main trunk and the posterior descending arteries. Then the heart was preserved in 10% formalin solution and forwarded to pathology department for histopathological examination.

Table 1: Rading of stenosis of both coronaries was carried out when the stenosis was

Observation	Grading
Absent in the vessels	Grade 0
Present and occluded less than 25% of the lumen	Grade 1
Present and occluded 25 to 50% of the lumen	Grade 2
Present and occluded 50 to & 0% of the lumen	Grade 3
Present and occluded more than 75% of the lumen	Grade 4

Table 2: Hile grading of presence of atheroma and calcification in both coronaries was conducted as follows when

Observation	Grading
Absence of atheroma and calcification	Grade 0
Presence of the atheroma and calcification, occluded less than 25% of the lumen	Grade 1
Presence of the atheroma and calcification and occluded 25 to 50% of the lumen	Grade 2
Presence of the atheroma and calcification and occluded 50 to 75% of the lumen	Grade 3
Presence of the atheroma and calcification and occluded more than 75% of the lumen.	Grade 4

The above table shows that maximum number of cases of age group 46 -55 years followed by 36-45 and 56 – 65

Table 3: Age and sex wise distribution

S.No.	Age (years)	Male	Female	Total	Percentage
1.	26 - 35	05	0	5	08
2.	36 - 45	16	0	16	26
3.	46 - 55	12	5	17	28
4.	56 - 65	12	4	16	26
5.	66 - 75	04	0	4	07
6.	>76	01	2	3	05
Total		50	11	61	100

years. Male out numbers the females.

Table 4: Comparison between age and dietary habit

S.No.	Ag(Years)	Vegetarian diet	Percentage	Mixed diet	Percentage
1.	26 - 35	10	16	01	02
2.	36 - 45	05	08	02	03
3.	46 - 55	18	29	04	06
4.	56 - 65	12	20	02	03
5.	66 - 75	04	07	01	02
6.	>76	01	02	01	02
		50	82%	11	18%

The above table shows that most of the deceased were vegetarians (50) and mix diet (Veg and Non-veg) include 11 cases. Not a single case observed having complete non-vegetarian diet.

Table 5: Comparison between age and nicotine consumption

S. No.	Age (Years)	Smoker	Non-smoker	Tobacco chewing
1.	26 - 35	01	04	08
2.	36 - 45	01	04	05
3.	46 - 55	01	02	19
4.	56 - 65	00	00	11
5.	66 - 75	01	00	03
6.	>76	00	00	01
Total		04	10	47

It is observed that tobacco chewing is more common as compared to smoking, commonly affected age group is 46 to 55 years followed by 56 – 65 years of age. The peoples are chewing Gutka more as compared to smoking because most of working place is having limited movements due to security purpose. The Gutka comprises lime, pieces of betel nuts, catechu, paraffin wax, sweet or savory flavoring agents and a variety of tobacco product varies from crud to refined preparation.

In the city there are many industries like textile, diamond cutting and polishing, jerry etc. and most of them have indoor working conditions therefore the worker usually sit or remain inside for hours while doing their job. WHO classification of BMI and individuals health status.

1. < 18.5 Under weight

Table 6: Comparison between age and work place

S. No.	Age (Years)	Indoor	Out door
1.	26 - 35	05	02
2.	36 - 45	06	08
3.	46 - 55	17	02
4.	56 - 65	12	05
5.	66 - 75	03	0
6.	> 76	01	0
		44	17

    2. 18.5– 24.9 Normal weight
    3. 25 – 29.9 Over weight
    4. 30 Obese

The figure shows that in present study 30 (49%) deceased were overweight and 10 (16%) were obese

Table 7: Comparison between body weight and length of the deceased.

Weight (KG)	Length (CM)				
	150 – 159	160 – 169	170 - 179	180 - 189	Total
41 - 50	-	4	-	-	04
51 - 60	4	5	1	-	10
61 - 70	7	10	3	-	20
71 – 80	1	12	4	2	19
81 - 90	1	-	2	-	3
91 - 100		3	2	-	5
Total	13	34	12	2	61

It is observed that maximum number of cases belong to weight group 61-70 kg followed by 71-80 kg group while according to length maximum number of cases are in 71-80 kg group.

Table 8: Grading of atherosclerosis

Type of atherosclerosis	Number	Percentage
II	2	03
III	6	10
IV	13	21
V	16	26
VI	24	40
Total	61	100

On histopathological examination grade VI atherosclerosis in coronaries were found in 40% cases followed by grade V in 26% cases. It is suggest that atherosclerosis is common in most of the sudden death cases and maximum observation seen of grade VI.

On gross examination stenosis and atheroma is common in both coronaries, but left coronary shows almost double the gross changes than right one.

Table 9: Gross observations in coronary arteries

Gross observation	Right coronary artery	Left coronary artery	Total	P- Value
Stenosis	26	30	56	0.07
Atheroma	17	39	56	0.214
Calcification	16	32	48	0.536
Thrombus	08	13	21	0.913

Table 10: Observation of stenosis in right coronary artery in both sexes

Observations	Male	Female	Total
Grade 0	27	9	36
Grade 1	11	2	13
Grade 2	11	0	11
Grade 3	01	0	01
Grade 4	00	0	00

Chi-square =3.844, P –value -0.2743) i.e. there is no significance association of stenosis in right coronary artery in both sex.

Table 11: Observation of stenosis in left coronary artery in both sexes

Observations	Male	Female	Total
Grade 0	25	6	31
Grade 1	12	2	14
Grade 2	7	0	07
Grade 3	2	2	04
Grade 4	4	1	05

Chi-square =4.488, P –value -0.3440) i.e. there is no significance association of stenosis in left coronary artery in both sexes. Grade 0 stenosis of left coronary artery was more in both sexes followed by grade 1. Grade 3 and 4 stenosis of left coronary artery was more in male as compared to female whereas grade 2 stenosis was observed only in male.

Table 12: Histopathological observations

S.No.	Age (Years)	AC MI	Healed MI/other	No findings
1.	26 - 35	1	2	1
2.	36 - 45	2	7	6
3.	46 - 55	5	5	8
4.	56 - 65	2	6	8
5.	66 - 75	2	0	3
6.	> 76	1	1	0
Total		13(16%)	22(36%)	26(43%)

The above table shows that out of 61 cases, 35(57%) cases revealed positive histopathological findings out of them 13 cases of acute myocardial infarction and 22 cases revealed healed myocardial infarction or degenerative changes, while 26 (43%) cases does not show any changes. It is suggestive that histopathological examination definitely

has role in establishment of sudden death of cardiac origin, if the autopsy surgeon suspects on the basis of history and gross observation of heart.

3. Discussion

Most of the sudden death of cardiac origin are due to ischemic changes in myocardium. It results from the lack of adequate blood perfusion to the myocytes, leading to a deficiency of oxygen and nutrients, resulting in abnormal function. In a clinical setting, myocardial ischemia is assessed by an individual's symptoms and electrocardiographic (ECG).[10] studies. The ECG changes may include ST-T segment wave alterations [64]. Myocardial ischemic manifestations are vague and multiple. Symptoms may include chest pain (angina), epigastric and arm discomfort with exertion or at rest, shortness of breath, nausea, and vomiting.[11] However, these symptoms may be subtle and are not easily recognized. Key TJ, Frase GE et al.**,** observed that IHD is more common in Non vegetarian as compared to vegetarian while in our study vegetarians are more affected than non-vegetarian.[12] According to study patient having high body mass index have higher survival rate while we observed most of the deceased are either overweight or obese.[13]

Several authors studied that smokeless tobacco is also harmful as compared to smoking. The effect of tobacco is inform of fibrosis and narrowing of vessels. In our study we also observed that people are using more smokeless tobacco as compared to smoking and resulting in sudden death. Authors has also observed that people consume smokeless tobacco are also on high risk of cardiovascular disease and in our study we also observed that deceased consume SLT are affected more to sudden death of cardiac origin as compared to smoking.[14–18] Atheroma and calcification is common in the coronary arteries in sudden death cases. In present study it is observed that coronary atheroma present in almost all autopsies. The youngest male of 28 years old show atheroma and calcification in the coronaries. The adult cannot be divided into subjects having and those not having atherosclerosis, the disease could be further classified according to the degree of stenosis in each artery. This concurs with the findings of Strong & McGill. Thrombosis complicating the atheroma and calcification was present in 13 cases in left coronary and in 8 cases in right coronary. In five cases thrombus was found in right coronary and in one case thrombus was found in left coronary in the absence of atheroma and calcification. This supports the suggestion of Gresham and Howard[19,20] that coronary thrombosis can occur in the absence of atherosclerotic plaques.

It is observed that there is a strong correlation between the arterial lesions and ischemic heart disease in both the incidence and severity. The atheroma and stenosis were commonly observed in the hearts that showed ischemic changes. This support the observations by Strong and McGill who opine that this correlation between coronary lesions and fatal ischemic heart disease suggest that the modern epidemic is based primarily on atherosclerotic lesions rather than a terminal episode such a thrombosis, and that the severity of coronary lesions is the determining factor in morbidity and mortality from ischemic heart disease. The above findings were supported in present study that males subjects are more as compared to female and the incidence of myocardial infarction is increasing as the age advances but more in age group 46 – 55 years followed by 56 -65 years. In present study it observed that there was a correlation between myocardial infarction the stenosis in the coronaries. This support the study carried at Maulana Azad Medical Collage, New Delhi.

4. Summary and Conclusion

A total of 61 sudden death cases were taken up in this study. Among the subjects there were cases of acute myocardial infarction and healed myocardial infarction. Subjects comprised of both males and females, maximum age of the deceased was 93 years and minimum of 28 years. Out of 61 cases studied, the percent of males and females was 81.96 and 18.04% respectively. Comparison was made between males and females. Body weight of the subjects varied between 43 and 93 Kg. there is presence of stenosis, atheroma and calcification in both coronaries and in few cases had thrombus. Subjects with stenosis were further grouped based on their severity of the stenosis.

1. Out of the total subjects males were outnumbered the female
2. Maximum number of cases were between of the age group 46-55 years followed by the age group 36-45 and 56-65 years
3. Most of the subjects had the body weight between 61-70 kg followed by 71-80 kg
4. Histopathological examination of coronary arteries revealed in 24 cases (39.34%) grade VI atherosclerosis and 16 cases (26.23%) grade V atherosclerosis.
5. The histopathological examination revealed positive result in 35 cases (57%) out of which, acute myocardial infarction in 13 cases and in 22 cases presence of healed myocardial infarction, degenerative and fibrotic changes while in 26 cases there was no microscopic changes were observed.
6. Gross examination of coronaries shows stenosis in both of the coronary arteries while atheroma and calcification was more common in left coronary as compared to right coronary. Four of the cases did not show any gross observations and out of them, in two cases there were no positive microscopic observations while in one case microscopic observations revealed healed infarction while in another case there were changes of acute infarction.

7. Atheroma in both coronaries and in both sexwas observed on gross examination

8. In right coronary artery, grade 4 stenosis was not observed in both male and femalebut grade 2 and 3 stenosis was observed only in maleand grade 0 and 1 stenosis was observed both in male and female. Grade 0 stenosis was more in both the male and female followed by grade 1 stenosis.

9. There is no significance association of stenosis in left coronary artery in both sexes. Grade 0 stenosis of left coronary artery was more in both sexes followed by grade 1. Grade 3 and 4 stenosis of left coronary artery was more in male as compared to female whereas grade 2 stenosis was observed only in male.

5. Source of Funding

None.

6. Conflict of Interest

None.

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