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CORONARY ATHEROSCLEROSIS IN CASES OF SUDDEN CARDIAC DEATH : AN OVER VIEW WITH HISTOPATHOLOGICAL FINDINGS IN ROUTINE AUTOPSY MATERIAL IN A TERTIARY CARE CENTER.

Cardiology

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ABSTRACT

Sudden cardiac death is the most common form of death occurring in the young, adult and elderly. The incidence of which is increasing worldwide.

Objective: Is to evaluate the cause of sudden cardiac death either ischemic (Atherosclerotic) or non-ischemic(non atherosclerotic).

Materials and Methods: this is a descriptive study conducted at the Department of Pathology, Bangalore Medical College and Research Institute which is attached to Victoria hospital (tertiary center) .The study was randomly chosen for a month of every year between 2013 to 2016. The autopsy cases were sent from the Department of Forensic Medicine, Bangalore Medical College and Research Institute. The heart was fixed in 10%formalin weighed and dimensions noted. The three major coronary arteries were dissected and then sectioned by multiple closely spaced cuts. The exposed arteries were carefully examined for any thickening, yellow streaks, acute plaque change or calcification. Routine processing and paraffin embedding, 4mm sections were taken. Sections were stained with Hematoxylin and Eosin stain and examined.

Results: In this study there were 70 cases of sudden cardiac death. The age ranged from 4yrs to 90yrs. Median age is 38yrs .Out of the 70 cases 58(82.9%)cases were males and 12 (17.1%)cases were females. Male to female ration was 8:1. About 58 cases (82.9%) were of ischemic etiology; 12cases (17.1%) were of non ischemic cause. The highest sudden cardiac deaths were reported in the age group of 21 to 30yrs constituting 23 cases(32.9%),followed by in the age group of 31-40yrs i.e. 4th decade of life where21 cases(30%) were seen. Only 1 case (1.4%) was seen in the age group of 0-10yrs suffering from Triology of Fallot. Similarly 1 case (1.4%) was in the age group of 80-90yrs.The most common lesion encountered was Coronary Artery Disease (41 cases) accounting for 58.6% followed by Myocardial Infarction (10 cases) accounting for 14.3% cases. The commonest major artery which was involved by atherosclerosis was Left Anterior Descending Artery (56.5%) followed by Right Coronary Artery was (30.5%) and Left Circumflex artery (13%). Lastly the involvement of coronary vessels in atheroma formation were single vessel 30 cases (42.9%), double vessel 34 cases (48.6%) and triple vessel in 6 cases (8.6%).

Conclusion: The formation of these lesions can be prevented by monitoring life style, dietary habits and health care programs.

KEYWORDS

Sudden death: atherosclerosis, Autopsy study, Myocardial Infarction.

Introduction: Atherosclerosis is defined as a disease of elastic vessels (Aorta, Carotid, Iliac, Coronary etc.)Atherosclerotic lesions start from very early ages before its complications are identified and the prognosis of the lesions are varied[1]. Sudden cardiac death occurs in adults and elderly persons wherein atherosclerosis is the most common cause[2]. In the young, congenital and acquired causes may account for sudden cardiac death[2]. Sudden cardiac death is defined as death within 24 hrs from the onset of symptoms[3]. But the most common definition of sudden cardiac death is instantaneous cessation of cardiac output in individuals[3].

Ischemic heart disease is the most common leading cause of death worldwide in both men and women[3]. In more than 90%, the cause for Myocardial infarction is reduced blood flow due to obstructive atherosclerotic lesion in the coronaries. Therefore, ischemic heart disease is also termed as coronary artery disease (CAD) or Coronary heart disease[3]. Incidence of sudden cardiac death increases with age and 2 to 3 times higher among men than women[4].

Coronary artery disease due to atherosclerosis is like an epidemic in India. The incidence has doubled during the past 3 to 4 decades. It will soon emerge as a single largest disease accounting for nearly 1/3rd of all deaths in India[5].

Materials and Methods: This was a descriptive randomized study from 2013 to 2016; the study was randomly chosen for a month of every year. The study was undertaken at Victoria Hospital, Department of Pathology, Bangalore Medical College and Research Institute .The autopsy cases were sent from the Department of Forensic Medicine of the same institute. The history and clinical diagnosis were obtained at the time of autopsy.

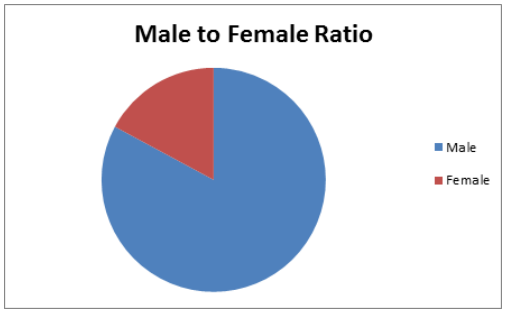
The heart was fixed in 10%formalin weighed and dimensions noted. Later the presence of scars of MI, measurements of right ventricular wall, left ventricular wall and interventricular septum were noted. The circumference of mitral and tricuspid valves were noted. Inflow - outflow method of heart dissection done. The three major coronary arteries were dissected and then sectioned by multiple closely spaced cuts with the scalpel. The exposed artery was carefully examined for any thickening, yellow streaks, acute plaque change or calcification. Routine processing and paraffin embedding.4mm sections were taken. Sections were stained with H and E stain and examined by using 10X, 40X. All the histological sections were examined for atheroma, Ischemic Heart Disease and Myocardial Infarction. The stenosis of coronaries were graded based on luminal narrowing of coronaries and is graded from Grade0 (normal) to grade IV (complete obstruction).

Grade 0 - Normal
Grade I - 1%- 25% stenosis
Grade II - 26%-50% stenosis
Grade III - 51%-75% stenosis
GradeIV - 76%-100% stenosis.

Results:

Total no of cases in this study was 70 out of which 58(82.9%) cases were males. 12(17.1%) cases were females. Male to female ratio was 8:1.

Figure IA-Sex Distribution



The age group ranged from 4-90 years. The mean age was 38years. The highest number of sudden cardiac deaths were reported between 21 to 30 years.(32.9%). i.e 3rd decade of life followed closely in the age group of 31 to 40 yrs(4th decade) constituting 21 cases (30%). 1 case was noted in the age group of 1-10 yrs with the diagnosis of Triology of Fallot.

Table IB- Age Distribution:

Age(yrs)	Number of cases	Percentage
0-10	01	1.4 %
11-20	00	0%
21-30	23	32.9%
31-40	21	30%
41-50	07	10%
51-60	12	17.1%
61-70	03	4.3%
71-80	02	2.9%
81-90	01	1.4%
TOTAL	70	100%

Based on the etiology Ischemic /atherosclerotic cause constituted 58(82.9%) cases. Non-Ischemic /non atherosclerotic 12 cases(17.1%).

Table II-Etiology of Sudden Cardiac death

Causes	Number of cases	Percentage
Ischemic	58	82.9 %
Non Ischemic	12	17.1%

Various histopathological findings were made. The most common diagnosis was coronary artery disease 41(58.6%)cases followed by myocardial infarction 10(14.3%)cases. 2 cases each (2.9%) of Myocarditis and Hypertrophied Cardiomyopathy were seen. 3 cases (4.2%) of ARVD were made.4 cases (5.7%) of CAD with biventricular hypertrophy were made. 6 cases (8.6%) Coronary Artery Disease with old Myocardial Infarction were made 1 case(1.4%)case each of pancarditis and rupture of Left Coronary Artery were made.

Table III-Histopathological findings

Histopathological findings	Number of cases	Percentage
Coronary Artery Disease	41	58.6%
Myocardial Infarction	10	14.3%
Myocarditis	02	2.9%
Pancarditis	01	1.4%
Hypertrophic Cardiomyopathy	02	2.9%
Arythmogenic Right Ventricular Dysplasia	03	4.2%
Coronary Artery Disease with biventricular hypertrophy	04	5.7%
Coronary Artery Disease with old Myocardial Infarct	06	8.6%
Rupture of Left Coronary Artery	01	1.4%
TOTAL	70	100%

Coronary atherosclerosis involvement was seen in the three major vessels i.e. Left Anterior Descending artery showing 56.5% followed by Right Coronary Artery 30.5% and Left Circumflex Artery with 13.0%.

Table IV-Frequency distribution of atherosclerosis in three major arteries.

Left anterior descending artery		Right coronary artery		Left circumflex artery	
No. of cases	percentage	No. of cases	percentage	No. of cases	percentage
13	56.5%	07	30.5%	03	13%

The involvement of coronary vessels in atheroma formation is as follows. 6(42.9%) cases of single vessel followed by 34(48.6%) cases by double vessel and lastly 6 cases(8.6%) had triple vessel involvement.

Table V-Involvement of coronary vessels in Atheroma formation.

Single vessel		Double vessel		Triple vessel	
No. of cases	percentage	No. of cases	percentage	No. of cases	percentage
30	42.9%	34	48.6%	06	8.6%

Discussion- In the present study there were 70 cases of autopsied heart, out of which 58 (82.2%) cases were males and 12 (17.1%) cases were females. These findings were similar to Chandrakala Joshi[3] wherein 115 cases wherein 115 cases were reported out of which 98 (85.21 %) cases were males and 17(14.78%) cases were females. A study conducted by Dinesh Rao et al[6] revealed 204 cases of sudden cardiac deaths. Out of which 184 cases (90.2%) were male and 20(9.8%) were female. A study conducted by Monika[5] Garg et al revealed 93 cases (80.9%) and female 22 (19.1%) cases. The above studies more or less are in concordance with the present study. Male dominance was noted in the above studies. In our study the ratio between male to female is 8:1. Whereas Chandrakala Joshi[3] showed male : female as 6:1. In the similar way Dinesh Rao et al[6] showed a ratio of 9:1 for 204 cases.

The age group involved in our study was 4 to 90 years. Mean age group is 38 years. Chandrakala Joshi[3] showed an age group of 11 to 90 years old.

A study conducted by Monika Garg et al[5] reported the age group of 15 to 85 years. Mean age 35 years. Similarly a study conducted by A Fabre et al[7] showed the age group between 15 to 81 years. A study by Vandana P et al[11] showed the age group involvement was in the age group of 15 to 80 years. Mean age was 32 years.

The most common age group involved by atherosclerosis in our study, was between 21 to 30 years (32.9%) cases followed by 31 to 40 years, 21 (30%) cases. The findings show that the age group involved was during the 3rd and 4th decade of life. Monika Garg et al[5] reported similar age group of involvement i.e. 3rd and 4th decades of life with 28(24.3%) cases and 31(27%) cases respectively. Vandana P et al[11],Gauravi, A Dhruva et al[12] and Dhinesh Beelwal et al[14] also reported maximum no. of cases in the 4th decade of life.

The causes of sudden cardiac death can be ischemic (atherosclerotic) or non- ischemic (non- atherosclerotic).

In the younger victims of sudden cardiac death ; the non-atherosclerotic are more common including hereditary (channelopathies) or organized abnormalities of the cardiac conduction system.

- Congenital coronary arterial abnormalities.
- Mitral valve prolapse
- Myocarditis or sarcoidosis
- Dilated or hypertrophied cardiomyopathy
- Pulmonary hypertension
- Myocardial hypertrophy

Increased cardiac mass is an independent risk factor for sudden cardiac death; thus in some young person who dies suddenly including athletes, hypertensive hypertrophy or unexplained increased cardiac mass is the only pathological finding[8].

Based on the above concept in our study there were 58(82.9%) cases with ischemic etiology whereas there were 12(17.1%) cases were non ischemic.

Eeva Hookana et al[9] reported 78.2 % cases of ischemic cause i.e. coronary artery disease. The prevalence of non-ischemic sudden cardiac deaths was 21.8% of all the sudden cardiac deaths. Love R Bhagora et al[10] reported 147(93%) cases of ischemic cause, 11 (7%) cases of non-ischemic etiology.

From the above findings it is evident that ischemic cause (atherosclerosis) plays a very important role in cases of sudden cardiac death.

In this study the major histopathological findings were Coronary Artery Disease with maximum number of cases i.e41 cases(58.6%) followed by Myocardial infarction with 10(14.3%)cases;6(8.6%) cases of coronary artery disease with old myocardial infarction; 4(5.7%) cases with coronary artery disease with biventricular hypertrophy. 3(4.2%)cases of Arrhythmogenic Right Ventricular Dysplasia; 2 (2.9%)cases of Myocarditis and Hypertrophic Cardiomyopathy and lastly 1(1.4%)case each of Pancarditis and Rupture of Left Coronary Artery.

Chandrakala Joshi[3] reported 74 cases of coronary artery disease (64.34%) followed by Myocardial infarction with 33(28.69%) of cases. The remaining non ischemic histopathologic findings were Myocardial Hypertrophy with60cases(52.17%);Myocarditis11(9.5%) cases;6(5.21%) cases of vaso occlusive crisis in sickle cell ,5(4.34%) cases of fatty streak and 1(0.86%) case of Pericarditis.

Dinesh Rao et al[6] also reported maximum number(116) of cases of

Coronary artery disease followed by 104 cases of Myocardial infarction;18 cases of Ventricular Rupture;13 cases of Rheumatic heart disease;12 cases of hypertensive heart disease;9 cases of Pericarditis;6 cases of Myocarditis and Hypertrophied cardiomyopathy;5 cases of Alcoholic Cardiomyopathy.2 cases each of Aneurysm of Heart and Restrictive Cardiomyopathy . Finally one case of Atrial Myxoma.

Love R Bhagora et al[10] have reported 125(46.82%) cases of Coronary Artery disease; acute myocardial infarction 22 (8.24%) cases; 4(1.5%) cases of cardiac hypertrophy; 2(0.75%) cases each of cardiomyopathy and other pathology in heart. Lastly 1 (0.37%) case each of aortic rupture, aortic stenosis and valvular heart disease. On analyzing the above studies it is very evident that cases of coronary artery disease is the maximum. This is followed by cases of myocardial infarction. And the rest are cases of non ischemic etiology.

In our study the frequency of distribution of atherosclerosis in the major arteries were as follows; Left anterior descending artery -56.5% followed by right coronary artery 30.5% and left circumflex artery-13%. In a study represented by Monika Garg et al[5] showed significant atheroma involvement in left anterior descending(38.1%), right coronary artery in 31.1% and left circumflex artery was involved in 34% cases. Dinesh Rao et al[6] reported 42.6% cases in left anterior descending and 51.5% of cases in the right coronary artery. Vandana Porwal et al also reported 46.6% cases in left anterior descending which was followed by right coronary artery with 41.71% cases. Least frequently involved vessel was left circumflex artery with 38.83% cases. Gauravi A Dhruva et al[12] reported left anterior descending was 40%, right coronary artery 32% and left circumflex artery 30%.

M Lakshmi Sudha et al[13] also reported that LAD was the most common site for plaques(47%) followed by Right coronary artery. Finally Dinesh Beelwal et al[14] also revealed that the most common artery involved is Left anterior descending artery(60.9%) followed by left circumflex artery(47.4%) and the least involved is right coronary artery in(30.4%)of total cases.

On discussing the involvement of atherosclerosis in the major arteries, it is found that the above studies have LAD as the most frequently involved vessel. This is because it causes infarction of the anterior wall of the left ventricle, the anterior two thirds of the interventricular septum and most of the heart apex. More distal occlusion of the same vessel may affect only the apex. This was followed by involvement by right coronary artery and left circumflex artery.

Lastly, the involvement of atherosclerosis in single vessel was 30 (42.9%) cases; double vessel was 34(48.6%) cases and triple vessels 6(8.6%) cases were reported in our study. Double vessel involvement was most common in our study. The above study was co-related with Monika Garg et al[5] wherein single, double and triple vessel involvement were 13.3%, 42.2% and 44.4% respectively. Triple vessel involvement was most common in studies conducted by Vandana P et al[11], Gauravi A Dhruva[12], Dinesh Bheelwal et al[14] and Paresh Shiladaria et al[15].

Our study highlights the importance of atherosclerosis in sudden cardiac death. Complicated atheromatous plaques were noted in a few cases. The most common being calcification. The study of human atherosclerotic lesion is an extremely difficult task in a living subject. Hence autopsy study is the best possible method. Though our study involved only a small number of cases, most of our observation correlated with similar studies.

CONCLUSION: In conclusion, males have a predominance of coronary artery disease than females. Until menopause, estrogen in females has a protective effect against atherosclerosis. Males indulge in alcoholism which explains male preponderance towards the development of atherosclerosis. Stress,sedentary lifestyle, lack of exercise and poor dietary habits are the important factors for early intitation and development of atherosclerosis in the young and middle aged.

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