

# Autopsy Study of Sudden Death Cases With Special Reference to Histopathological Changes in Heart

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## ABSTRACT

**Background:** Sudden cardiac death and arrhythmia accounts for 15 – 20% of all deaths. Though Coronary artery disease is the major cause of sudden deaths, diagnosis of other underlying causes is necessary. Hence we intended to analyze the various cardiac causes related to sudden deaths and the associated histopathological findings of heart.

**Methods:** Present study was an autopsy based cross sectional observational study conducted at Madurai Medical College mortuary for a period of one year. 100 cases of sudden deaths were subjected to autopsy and histopathological changes of heart were studied.

**Results:** In the present study, majority of cases belonged to the age group of 40 - 60 years with male preponderance. In histopathological examination, atherosclerosis was the most common finding with involvement of left anterior descending artery. Other findings include myocardial infarction, myocarditis, pericarditis and dysarrhythmogenic ventricular hypertrophy. Multiple cardiac lesions were noted in few cases.

**Conclusion:** An accurate diagnosis of the underlying morbidity at risk of sudden death either at postmortem or in living patients and life threatening arrhythmias is the pre - requisite to adopt therapeutic and preventive strategies.

**Keywords:** Sudden Cardiac Death, Histopathology of heart.

## INTRODUCTION

Sudden death can be defined as deaths occurring within 24 hours from the onset of symptoms. Sudden cardiac death as a consequence of cardiovascular event with or without an existence of cardiovascular pathology accounts for about 45 to 50% of total incidence of sudden deaths. Sudden death of young and healthy adult has a profound impact on the psyche of the society. It is estimated that 60% of coronary artery disease patients are South Asians<sup>1</sup>.

The underlying cardiovascular pathology in sudden deaths in most patients in the Indian subcontinent is atherosclerosis, whose progression and acceleration is proportional to the traditional risk factors, altered lifestyles and inherent risk factors. The atherosclerotic process culminates in ischemic heart disease and current trends point to increasing incidence of ischemic heart disease in young population<sup>2</sup>. Furthermore the initial manifestation of ischemic disease is sudden cardiac death.

Garg S et al<sup>3</sup> study revealed that most of the cardiovascular deaths occurred within age range of 41 to 60 years and coronary atherosclerosis was found to be the most common finding. Histological evidence was present in 14% of cases in the study. Sonowane S.Y. et al<sup>4</sup> carried out a study at a tertiary institution in India regarding pathology of heart coronaries, and aorta in autopsy cases. Atherosclerotic coronary artery disease was found to be the common lesion followed by hypertensive heart disease. Old healed myocardial infarction was found to be the predominant type of myocardial infarction and most of the infarction was of transmural type.

In the study conducted by Sreelakshmi et al<sup>5</sup>, most cases of hypertrophic cardiomyopathy were observed in young men and accounted for about 14.7% of this study. Shubangi et al<sup>6</sup> study revealed a wide spectrum of changes, the most common being atherosclerosis found in 35 to 95% cases, myocarditis with pericarditis in 9% cases, chronic ischaemic heart disease in 4% of cases. Also in histological grading of atherosclerosis, they observed maximum number of cases in grade 3 followed by grade 4. Double and triple vessel involvement was seen in most cases and the most common coronary involvement is Left anterior descending artery followed by left circumflex artery in their study.

Uma N. Srivatsava et al<sup>7</sup> study revealed that sudden cardiac death occurred in 39.7 deaths/100,000 population of Tirunelveli. Frequency of sudden cardiac death in males was found to be 4 to 5 times greater than in females. Shanthi et al study shows that most common age group involved was 50 - 60 years. Histo-morphological changes observed were atheromatous change in aorta in most cases<sup>8</sup>. Autopsy of 50 sudden death cases revealed atherosclerosis in 35% cases followed by myocardial infarction with early changes in 18% cases and thrombus in coronary in 18% cases.

Mawrahnisha et al<sup>9</sup> revealed that ischemic heart disease was responsible for 30% of sudden death, acute myocardial infarction in 7% cases. In their study, calcification was

seen in cases with complicated atherosclerosis by vonkossa stain and elastin fibres by von giemsa stain.

The present study was undertaken to establish the nature of cardiac diseases associated with sudden death and to analyze the various histopathological changes of heart in sudden deaths.

## MATERIALS AND METHODS

The present study was an autopsy based cross sectional study conducted at the mortuary of Madurai Medical College from the period of September 2018 to September 2019. All cases due to sudden deaths autopsied at the mortuary of Madurai medical college and Govt Rajaji Hospital Madurai were included for the study except the cases with pre - existing congenital heart disease and sudden deaths with obscure histories. Total number of autopsies done during the above period was 3405 out of which 100 sudden deaths which fulfill the criteria were taken for the study.

Autopsies were performed by Lettule's method of en masse removal of viscera with the aim to observe histopathological changes that could guide to cause of death especially when there is history of no specific disease or co - morbidities. The thickness of walls of heart, the weight of the heart, regions of myocardial infarct (old and recent), coronaries of heart were examined using regular sections every 4-5 mm. Microscopic studies of heart was also done for intimal changes, lumen narrowing and atherosclerotic changes. All data were analysed descriptively.

## RESULTS

Autopsy and histopathological data of 100 cases of sudden death were collected. Maximum number of cases in the study belonged to the age group 40 to 60 years with significant male preponderance was noted. 90% of the deaths occurred outside the hospital. With regard to the duration between onset of symptoms and death, 26 cases out of

100 cases died in short period i.e. within 30 minutes, 43 cases within few hours of onset of symptoms i.e. 6 to 24 hrs and 30 cases after 24 hours and in 10 cases, duration of onset of symptoms could not be evaluated due to non availability of specific history.

51% of cases had weight of the heart in the range 301 – 400 gms, 33% with range 201 – 300 gms and in 115 of cases, the weight of the heart was below 200 gms. Only 5% of the cases had weight of the heart above 400gms. The involvement of heart wall was also noted and heart wall changes were observed in 20 cases in the study. The findings are as shown in Table 1.

In histopathological examination of 100 cases, the most common finding was atherosclerosis followed by myocardial hypertrophy and myocardial infarction. Dysarrthmogenic ventricular hypoplasia, Myocarditis and pericarditis were seen in less number of cases. No specific findings were observed in 10 cases during microscopic examination (Table 2).

**Table 1: Heart Wall involvement**

Heart wall involved	No.of cases	%
Biventricular Hypertrophy	5	25%
Left ventricular Hypertrophy	10	50%
Right ventricular Hypertrophy	5	25%
Total	20	100%

**Table 2: Histopathological Findings**

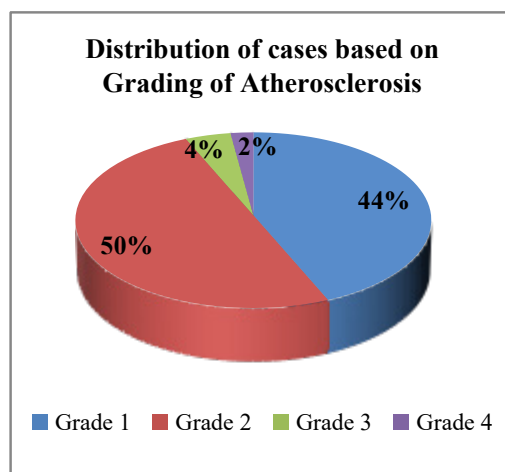
Histopathological Findings	No. of Cases	%
Atherosclerosis	46	46%
Myocardial hypertrophy	15	15%
Dysarrthmogenic ventricular hypoplasia	4	4%
Myocarditis	3	3%
Pericarditis	2	2%
No significant pathology	10	10%
Total	100	100%

In cases of atherosclerosis (46 cases), major blockage was noted in left anterior descending artery in 31 cases (67.3%), left circumflex artery in 10 cases (21.7%), right coronary artery in 5 cases (10.8%). Also, single vessel involvement due to atherosclerosis was seen in 41 cases (89.13%), double vessel involvement in 4 cases (8.7%) and triple vessel involvement was observed in 1 case (2.17%). Grading of atherosclerosis was done based on percentage of block (Chart 1). 50% of the cases had grade 2 block in the present study. (Chart 1)

Out of the 15 cases of myocardial infarction in the study, 12 cases showed old infarct, while 3 cases showed features of recent infarction. Multiple cardiac lesions were seen in 5 cases which consist of combination of two or more cardiac lesions like pericarditis, myocarditis, atherosclerosis and pericardial or myocardial haemorrhage (Table 3). Certain nonspecific findings like increased epicardial fatty tissue, left ventricle with few congested vascular spaces, right ventricle congestion etc in the heart were observed (Table 4)

## DISCUSSION

In the present study maximum number of cases was observed in age group 41 to 60 years. In adults SCD is a complication and often the first clinical manifestation of ischemic heart disease (Table 3 & 4)..



**Chart No.1: Distribution of Cases based on Grading of Atherosclerosis**

With decreasing age of the victim, the non - atherosclerotic causes of sudden death like congenital coronary arterial abnormalities, premature coronary artery disease, cardiomyopathies, mitral valve prolapse and myocarditis become increasing.

Data from across the world shows male preponderance with respect to sudden cardiac deaths which was the case in the present study also where males were 78 % and 22 % were females.

Coronary atherosclerosis in the present study is 46% cases. Atherosclerosis of coronary arteries and its downstream sequelae are responsible for most of the cardiac morbidity and mortality. Atherosclerosis with calcification was present in 26 cases whereas with thrombosis was present in 4% cases. Joshi C reported calcification in 17% cases and thrombosis in 5% cases. Patients with increased coronary atherosclerotic calcification appear to be at

more risk for coronary events. Thrombus is most dreadful complication of atherosclerosis and may partially or completely occlude the lumen. Plaque calcification is found more frequently in advanced lesions, it may also occur in small amounts in earlier lesions, which appear in 2nd and third decade of life. Histopathological investigations had shown that plaques with microscopic evidence of mineralization are larger.

In the present study major blockage was noted in left anterior descending artery followed by left circumflex artery 10 cases, Right coronary 5 cases. As per our study the coronary atherosclerosis was common and single vessel involvement was 89%, double vessel involvement was 8.6%, triple vessel involvement was 2.17%.

The next common lesion in present study was myocardial hypertrophy seen in 20 cases.

Myocardial infarction was present in 15% cases. In the present study recent myocardial infarction constituted 20% and old myocardial infarction 80% as compared to Joshi C study in which 45% were recent and 55% old myocardial infarction. Rao DS reported 24% recent and 27% old infarct<sup>10</sup>. In the present study myocarditis was found in 3% cases, in contrast to 9% in a study by Joshi C et al. Primary pericarditis is uncommon and is mostly secondary to infection.

**Table3: Multiple lesions**

Multiple lesions	No. of Cases	%
Atherosclerosis & Myocarditis	1	20%
Atherosclerosis, Myocarditis & Pericarditis	1	20%
Myocarditis and myocardial and pericardial haemorrhage	1	20%
IHD and Pericarditis	1	20%
IHD and Myocarditis	1	20%
Total	5	100%

**Table 4: Non - specific findings**

Non - specific findings	No. of cases	%
Increased epicardial fatty tissue	14	60.8%
congested vascular spaces in left ventricle	4	17.3%
Right ventricle congestion	3	13%
Cardiac muscle fibre congestion	1	4.3%
Arrhythmogenic dysplasia of right ventricle	1	4.3%
Total	23	100%

## CONCLUSION

In the present study, it was concluded that the most frequent lesion in the study of histopathological lesions of heart was atherosclerosis. Atherosclerosis was the main cause of MI and sudden deaths. In sudden deaths, cause of death cannot be found by routine autopsy where histopathological examination of organs becomes most important. When sudden death occurs in adults, coronary atherosclerosis is the main cause while myocarditis is the main cause in children. Our study findings shows the need for emphasis on strategies like stress reduction, life style modification, healthy diet, regular

exercise especially in the young people. Better screening tests for early diagnosis should be employed, drug therapy in selected individuals can reduce the risk of cardiac events, but at present Framingham risk assessment is suboptimal.

Histopathological studies provide the most accurate clues to a good understanding of cardiovascular diseases. With good insight into disease pathophysiology, novel interventions could be introduced to improve care and better outcomes for patients undergoing cardiovascular diseases. It is advisable to begin a sequence of investigations from a detailed family history to referral of parents, siblings and offspring to a cardiologist for screening.

## LIMITATIONS

Methods of diagnosing myocardial infarction in postmortem examination like three Tesla Magnetic Resonance imaging, Immunohistochemical detection of S100 calcium binding protein A1 and quantitative myoglobin assay were not carried out in the present study to find the cause of death since they are sophisticated and are not available in our study setting.

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**Ethical Clearance:** This research has received approval from the Institutional Ethics Committee of Madurai Medical College on 25.09.2018

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