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HISTO-PATHOLOGICAL CHANGES IN CORONARY VESSELS IN CASES OF SUDDEN CARDIAC DEATH- A POST-MORTEM STUDY.

Pathology

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ABSTRACT

Background: Incidence of sudden cardiac death (SCD) is on the rise and a large spectrum of cardiac diseases, both congenital as well as acquired may be responsible for this. Presence of coronary vessels atherosclerosis is the most important cause of SCD in adults. In many such cases, the patient may not have any symptoms, which is discovered on post-mortem examination of the coronary vessels.

Aims and Objectives: The aims and objective of this post mortem study was to analyse the gross and histopathological changes in coronary arteries in cases of SCD.

Material and method: 34 cases of SCD were taken up for this retrospective study, during last three and a half years. The demographic data, gross post-mortem findings and histopathological data in relation to coronary vessels was retrieved and analysed.

Observations and Results: There were 34 cases of SCD accounting for 8.33% of the total 408 post-mortem conducted during the period of study. Histopathologically, triple vessel disease was present in 67.6% cases and two vessel disease in 20.6% cases. Besides, there were 11.7% cases with single vessel disease. The left anterior descending artery(LAD), left coronary artery(LCA) and right coronary artery(RCA) showed more than 60% blockage in 64.7%, 44.1% and 41.2% cases respectively.

Conclusion: The study highlights that triple vessel disease is one of the most important contributing factor that may lead to SCD. To assess the degree of blockage in coronary vessels, histopathology is the most important tool.

KEYWORDS

Sudden Cardiac Death (SCD); Coronary Vessels; Atherosclerosis; Post-mortem; Histopathology.

INTRODUCTION

Sudden Death usually is defined as the one which is "unexpected. Non-traumatic, natural death which takes place within 24 hrs from the onset of symptoms and signs of disease. The Cardiac causes, which lead to death, are known as sudden cardiac death. This generally takes place within a short period of time, with or without prior symptoms of cardiac diseases. Causes of sudden cardiac death are coronary artery diseases, congenital Heart diseases including valvular heart diseases , cardio-myopathies, heart muscle abnormalities, ventricular fibrillation, myocarditis etc.

Beside cardiac causes there are other causes of sudden death which includes, cerebro-vascular diseases, Respiratory diseases, including acute respiratory distress syndrome, GI causes, Haematological causes, septic and haemorrhagic shock.

The present study was aimed at studying gross post-mortem findings and histopathological changes in all the three coronary arteries and the degree of blockage in cases of sudden cardiac deaths.

MATERIAL AND METHOD

The present retrospective study was carried out in our institute by the department of Forensic Medicine in collaboration with department of Pathology. During the period of study from January 2015 to July 2018, a total of 408 autopsies were performed in the hospital. Among these, there were 34 cases of sudden cardiac deaths. In all these 34 cases, Post-mortem records and histopathological slides were retrieved. Detailed data analysis was done including data on age, sex, clinical complaints prior to death, gross findings before and during autopsy and histopathological diagnosis.

In all these cases post-mortem was performed. Gross findings of heart and coronary vessels were noted. The heart was cut open in the direction of blood flow and after removal of the blood; fixation was done in 10% formal saline. After 24-48 hours when the fixation was complete, gross examination was done. Coronary arteries were examined by transverse cuts at 3-5 mm intervals all along their length. Atherosclerosis was visually looked for in all three coronary vessels. Tissue bits from left anterior descending artery (LAD), left coronary artery (LCA) and right coronary artery (RCA) were taken and processed. Blocks were prepared. The sections after staining with Haematoxylin and Eosin were examined and graded for atherosclerosis and blockage of the vessels.

OBSERVATION AND RESULTS:

During the period of study (From Jan 2015 to 2018), a total of 408 post-mortem were performed. Amongst these 408 cases, there were 34 cases of sudden cardiac deaths (8.33%). There were 27 (79.4%) males and 7 (20.6%) females, signifying male predominance in the series. There were 24 cases (70.6%) in the age group of 30-59 year, followed by 7 cases (20.5%) in the age group of 60-90 years. There were only 3 (8.8%) cases who were less than 30 years of age. In most of the cases of sudden cardiac deaths, the death occurred outside hospital (29 cases) (85.2%) whereas 5 cases died during treatment in the hospital. Symptoms related to heart diseases prior to death like chest pain were present in 13 cases (38.2%) only; where as in 21 cases (61.7) symptoms related to heart disease were not present. Symptoms like sudden loss of consciousness was not taken into account as symptoms related to heart diseases (Table I).

Table I: Demographic distribution and presence of symptoms (n=34)

S.N.	Age Groups	M F	Place of Death Outside M F	Hospital M F	Symptoms Related to heart disease Present	absent	Total
1.	<30 yrs	3 0	3 0	0 0	1	2	3
2.	30-59 yrs	19 5	16 4	3 1	10	14	24
3.	60-90 yrs	5 2	5 1	0 1	2	5	7
		27 7 (79.4%) (20.6%)	24 5	3 2	13 (38.2%)	20 (58.8%)	34

On comparing gross findings of post-mortem with that of histopathological findings, it was observed that on gross examination triple vessel disease was noticed in only 16 (47%) cases where as on histopathological examination it was found that 23(67.6%) cases had involvement of all three vessels. Two vessels were involved in 7 (20.6%) cases both on gross as well as on histopathology. Single vessel disease was noted in 5(14.7%) cases on autopsy but confirmed histopathologically in 4 (11.7%) cases only. There was one case of Left ventricular hypertrophy in which coronary arteries appeared patent on gross examination but it showed plaque in left coronary artery (Fig 2B). There were 4(11.7%) cases where gross examination was unremarkable. However 3 of these 4 cases had triple vessel disease and

one had 2 vessel disease on histopathology. There was one case where calcification (Fig 2A) was seen in coronary vessels on gross examination. This case showed calcification in right coronary artery, left coronary artery and a plaque in aorta on histopathology (Table II). It appears that some cases of atherosclerosis were missed out on gross examination during autopsy but were detected during histo-pathology.

Table II: Spectrum of Changes on Gross and Histopathology in Coronary Vessels (n=34) cases

Pathology Detected	PM- Gross	Histopathology
Three vessels involved (3)	16	23
Two Vessels involved (2)	7	7
Single Vessel (1)	5	4
LVH- all Coronary vessels Patent	1	Coronaries patent but plaque in LCA
U/R	4	3 cases All three vessels involved 1 case 2 vessels involved
Only calcification	1	Calcification in RCA, LCA plaque in Aorta
	34	34

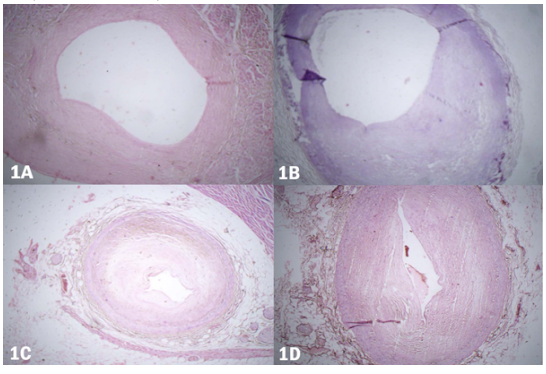
*U/R Unremarkable; LVH Left Ventricular Hypertrophy

Histopathological examination revealed significant changes in coronary arteries in cases of sudden cardiac deaths. LAD showed blockage of more than 60% in 22 cases (64.7%) (Fig 1C and 1D) and between 31- 60% in 4 cases (11.7% (Fig1 and 1B)). Blockage was less than 30% in one case. In seven (14.7%) cases, there were no remarkable changes in the LAD. In LCA, there were more than 60% blockage in 15 cases (44.1%). The blockage was between 31 to 60% in 7 (20.6%) cases and less than 30% blockage in 7 (20.6%) cases. The histological changes were unremarkable in 5 (14.7%) cases. In RCA more than 60% Blockage was seen in 14 cases (41.1%), 31-60% in 10 cases (29.4%) and less than 30% blockage in 5 cases (14.7%). There were no remarkable changes in 5 (14.7%) cases (Table III).

Table III: Pattern of Degree of Blockage in coronary vessels. (n=34x3)

S. NO	Artery	U/R*	% OF BLOCK <30%	31-60%	>60%	Total
1	LAD	7 (20.6%)	1 (2.9%)	4 (11.7%)	22 (64.7%)	34
2	LCA	5 (14.7%)	7 (20.6%)	7 (20.6%)	15 (44.1%)	34
3	RCA	5 (14.7%)	5 (14.7%)	10 (29.4%)	14 (41.2%)	34

*U/R (Unremarkable)



VFig 1: (1A) Coronary artery showing 30 to 40% blockage by atheromatous plaque;
(1B) Coronary artery showing partial blockage of 50-60% by an atheroma;
(1C) & (1D) Atheromatous plaque compromising more than 80% of lumen coronary vessel.

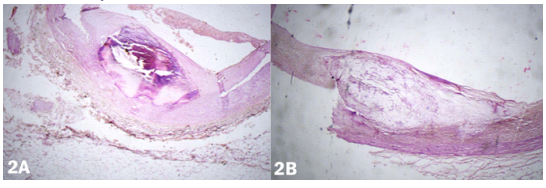


Fig 2: (2A) Lumen of coronary artery showing a calcified plaque; (2B) Atheroma showing foamy macrophages and cell debris.

DISCUSSION:

Sudden cardiac death is defined by WHO as the one which has taken place within 24 hours from the onset of symptoms and signs of disease [1,2]. In spite of large number of studies conducted so far, sudden cardiac death remains an enigma and relative importance of acute coronary events as a trigger of sudden death is currently unclear[3].

In a studied sample of 656 autopsies, Ahmed M. et al.[4] in their series reported that SCD accounts to about 10% of cases who underwent autopsy. There were 45.5% cases below 40 years of age in their series. This could be due to restrictive criteria, as all autopsy subjects being serving soldiers. In our series out of 408 cases, there were 34 (8.3%) cases of SCD. The SCD is more often seen in middle aged population. A study by Rao et.al[5] found 56.9% cases belonging to the age group of 50 to 59 years. Pantilla A.[6] in his study of 799 autopsies on adult males in age group of 25 to 64 years, found cardiovascular and especially ischaemic heart diseases comprised the major proportion of all unwitnessed, sudden and unexpected natural deaths. However, in our series we also observed that the highest number of cases of SCD (70.5%) fell in the age group of 30-60 years .

Men were found to have three-fold higher risk of SCD as compared to women[7]. Not only that, women who suffer from SCD are less likely to have a prior history of heart disease compared to men (37% versus 56%)[8]. Rao et.al. in their series of 204 cases of SCD amongst 2449 autopsies performed , reported a ratio of 10:1 males and female cases. Shah et.al.[9] had only 3 (6%) females in their series of 50 cases. In our series, there were 27 (79.4%) males and 7 (20.6%) females. It has been observed by many authors that in a large number of cases of SCD , it occurred so quickly that the victim is often unable to reach a medical facility. Ladich E. et.al.[10] found that SCD occurred within 2 hours of onset of symptoms. Rao et al. in their series observed that 76% cases of SCD occurred outside hospital and only 24 % of cases of SCD occurred in hospital settings. In our series as well, there was a clear trend of SCD happening outside hospital (85.3%) cases. There were only 14.7% cases where it took place in the hospital. This was suggestive of the fact that in most situations, there was not enough time to shift the patient to a hospital.

Atherosclerosis is a major risk factor for ischemic heart disease and sudden cardiac death[9,11,12] The most common cause of SCD is coronary atherosclerosis[4, 13]. Shah et.al[9] in their study of 50 cases of sudden cardiac deaths found that 82.3% of these cases were due to coronary heart disease. 21 (42%) cases of ischemic heart disease were associated with atherosclerosis and 6 cases (12%) showed only atherosclerosis without any other findings.

Ahmed et.al.[4] reported 79% of their cases of SCD having triple vessel disease whereas in 21 % of their cases of SCD there was no coronary atherosclerosis. Kasturi et.al. [13] reported that 80% cases of SCD were suffering from Triple vessel disease in their series. In our series, we found that on gross examination, there were plaques and blocks in 16 cases (47%) cases in all the three vessels whereas on Histo-pathology, triple vessel disease was found in 23 (67.6%) cases. Two vessel diseases were found in 7 (20.5%) cases on gross examination as well as on histopathology. The gross post-mortem examination had single vessel disease in 5 cases but in 4 of these cases had atherosclerosis present on histopathology. In one case there was no remarkable histo-pathological evidence of atherosclerosis

The evidence of occlusion on histopathology (HPE) was graded into three groups in our series. In our series more than 60% block was seen in 22 (64.7%) cases in LAD and in 15 (44%) cases in LCA. In RCA, more than 60% block was seen in 14 (41.2%) cases. Rao et al reported blockage in LAD (42.6%) and RCA (51.5%). Bohrod MG[14]. quoted the ranges from various published analysis as LAD to be 45-64%, while RCA came next in frequency (24-46%), followed by LCA in (3-10%) and the least affected is the left main coronary artery. Marwah et.al. [3] reported 32.5 % cases having triple vessel disease and significant atherosclerosis (>50%) in 62.5% cases. 29% cases showed no changes in coronary vessels. In our series, among 102 arteries (34x3) examined histopathologically, there were 17 vessels (16.7%) which did not have any evidence of atherosclerotic changes. The exact reason for non-involvement of some arteries from the generalized disease of atherosclerosis is un-explainable.

CONCLUSION: The present study suggests that triple vessel and double vessel diseases are most important contributory causes of

sudden cardiac deaths. The higher the degree of blockage due to atherosclerosis, higher is the risk of SCD. The study further highlights the significance of histopathological examination of autopsy tissue from the coronary vessels as in many of the cases gross examination of the heart may not detect the underlying coronary arteries pathology.

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