Hypertrophic Cardiomyopathy as a cause of Sudden Cardiac Death—An Autopsy Study

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Abstract

Sudden cardiac death (SCD) is an unexpected death with underlying cardiac pathology. Hypertrophic cardiomyopathy is one of the causes of SCD. It comes almost second important cause after Ischemic pathology. However, it remains to be explored. It is a 10-year retrospective study done between (2002-2020) including all the postmortem cases of SCD coming to the Department of Pathology for histopathological examination. The present study highlights various histopathological features of hypertrophic cardiomyopathy.

Keywords: *Sudden cardiac death, Hypertrophic cardiomyopathy, autopsy*

Introduction

Sudden Death as per WHO guidelines is defined as unexpected natural death within one hour or less from onset of symptoms; or a non-witnessed death within 24 hours in someone without prior symptoms.[1] SCD is an enigma and presents a great challenge to a pathologists and cardiac autopsy is a main diagnostic tool to ascertain the cause. [2]

In SCD underlying pathology has a great role with Myocardial infarction leading cause followed by Hypertrophic cardiomyopathy (HCM), conduction abnormalities etc. [3]

This study highlights HCM which acts as a silent killer particularly in young individuals. It is a primary myocardial characterised by hypertrophic non dilated ventricles and this is without any obvious cause such as hypertension or aortic stenosis. In HCM there is disproportionate hypertrophy of ventricular septum, with myofiber disarray in ventricular septum and left ventricular cavity, mitral valve thickening along with coronary atherosclerosis. [4,5]

The aim of the study is to highlight that HCM is an entity where there is SCD and diagnosis is made on autopsy. So, pathologist plays a vital role in diagnosis of HCM.

Material & Methods

The present study is a retrospective study done over a period of 10 years between 2002-2020 in which total 470 heart autopsies received in Department of Pathology were analysed. The specimens were received in 10% formalin.

Inevery case important detail regarding clinical history, suspected cause of death and postmortem findings were taken from forensic expert and post-mortempapers.

The gross examination is vital in studying cardiac pathology. Weight of heart, ventricular surface is examined along with status of coronary arteries. The heart specimens were opened by modified Virchow's method following the direction of blood flow. All the chambers were washed off any blood clots and examined for any pathology of valves or endocardium. Thickness of ventricular walls and interventricular

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septum was also measured. Multiple blocks were taken from representative areas. After routine processing haematoxylin and eosin staining was done.

On microscopic examination features which were highlighted were myofiber disarray, hypertrophy, fibrosis, nuclear features, and coronary artery atherosclerosis. Myofiber disarray was classified as per criteria established by Maron and Roberts. [6,7] They are as following

Category IA:cardiac muscles are aligned obliquely or perpendicularly to one another forming a tangled mass or pinwheel configurations

Category IB: myofibers are arranged in relatively broad bundles being normally arranged

Category IIA: relatively narrow (one or two cell) longitudinally cut bundles of cells interlaced in various directions among larger groups of transversely cut cells

Category IIB: like IIA except that longitudinal bundles are more linear.

Results

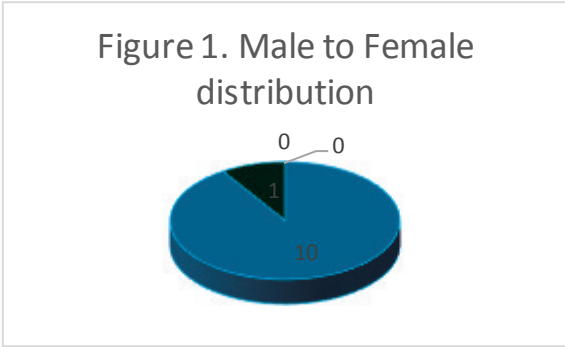
The study was conducted in Department of Pathology between period of 2002-2020 in which total 470 heart specimens were received and out of them 55(11.5%) were diagnosed hypertrophic cardiomyopathy.

The age ranged between 21-72 years (average 43.5years) with maximum cases occurring in 3rd and 4th decade (table 1).

Table No. 1 Age wise distribution of HCM

Age (years)	Total no. of cases	% of cases
0-19	01	1.8%
20-39	23	41.8%
40-59	20	36.3%
60-79	06	10.9%
80-99	05	9.2%

There is male preponderance with M: F of 10:1(Figure 1).

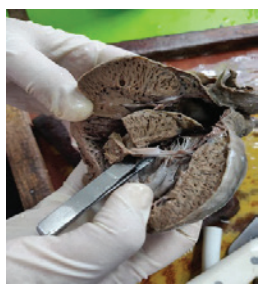


In all cases presentation with SCD with no previous history of any cardiac pathology. All this information was collected from detailed history provided in the police records provided as part of request letter.

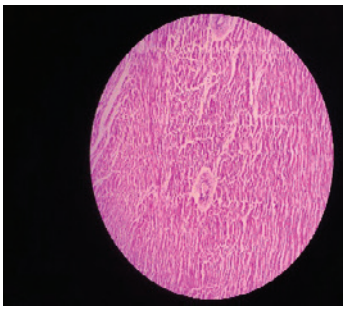
The weight of heart ranged between 300-880 gms (mean: 410 gms)(Picture1). On further grossing left ventricular thickness & interventricular septum ranged between 1.5-3.2 cms (average of 25.2 cms). Right ventricular wall thickness ranged between 0.8-2.0 cms (average of 1.3 cms).

45.5% of cases showed features of atherosclerosis in coronary arteries. In 18.1% cases degree of atherosclerosis was severe as there was foci of dystrophic calcification.

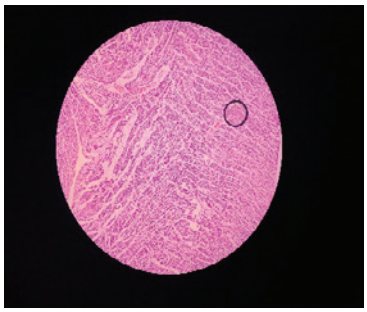
On microscopic examination of all cases myofiber hypertrophywas noted with increased nuclear size and hyperchromasia. The nuclei were cigar shaped. Focal patchy interstial fibrosis was also seen. The most important feature was myofiber disarray. Category 1A was the most common as described by Maron and Roberts. [6,7]About minimum of 20 sections were examined to describe the myofiber disarray [picture 2&3].



Picture 1: Gross examination of heart exhibiting cardiomegaly and increased left ventricular wall thickness.



Picture 2: Sections exhibiting myofiber hypertrophy (H&E X400)



Picture 3: Sections exhibiting myofiber disarray (H&E X400)

Discussion

Hypertrophic cardiomyopathy has been known by a confusing array of names, reflecting its clinical heterogeneity. It was the preferred name because it describes the disease spectrum.[8] it was an inherited autosomal dominant disorder in which proteins encoding the cardiac sarcomere are mutated.[9] These proteins play varied roles i.e. contractile, structural and regulatory. [10,11] This was a main reason of diverse HCM spectrum.

This disease affects a wide spectrum of age group and particularly younger patients i.e. less than 30 years of age.[12]Our study was in concordance with above said findings as the most common age group affected was in third and fourth decade (41.8%). But this disease spares none, as wide age group was affected from young as 20 years to 84 years.

Male preponderance was noted with male to female ratio of 10:1 which was consistent with findings of various studies which presented with 60% more male bias.[13] These findings are in contrast with genetic inheritance of disease i.e. being an autosomal dominant disorder it should be equal in both sexes. So, the underlying reason need to be explored and here autopsy plays a major role.

The clinical presentation of all individuals was sudden cardiac death, and this was the most common clinical symptom.[12] The presentation was common in all age groups thus highlighting a complex underlying pathology which needs to be explored further. But the most common precipitating factor of sudden death was arrhythmia.[6]

On gross examination of heart weight was on the higher side of normal for age and sex of the patient. In the present study heart weight ranged between 300-880 gms with average of 410 gms. This finding was same as in various studies where heart weight was increased. [4,5,6]

Microscopic examination of all specimens was done with extensive sampling of heart specimens as myofiber disarray was considered as gold standard. Maron and Roberts criteria was followed for quantification of disarray. [6,7] However as per various studies no single feature was diagnostic additional histological features like myofiber hypertrophy, boxing of nucleus with interstial fibrosis were also especially important. [6,7]

However, the main important feature was that myocardium shows asymmetric hypertrophy and extensive sampling holds the key for the correct diagnosis. This was supported by study done by Phadke et al and Davies MJ. [6,14] Thus stressing the role of autopsy pathology as biopsy can miss the area having pathology.

This study highlights that Hypertrophic cardiomyopathy was one of the causes of sudden cardiac death. Histopathological examination was the key which can be done only on extensive sampling. It was important as we can advise genetic testing of the family and thereby can diagnose the disease in the family.

Conclusion

Hypertrophic cardiomyopathy is an autosomal dominant disorder and important cause of sudden cardiac death. It is a silent killer which runs in the families. Autopsy plays an important diagnostic role with histopathological findings holding the key for diagnosis.

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Conflict of Interest: NIL

Ethical Clearance: Taken

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