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Original Research Article

Spectrum of various histomorphological changes in heart studied with autopsy specimens - An institutional observational study

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ABSTRACT

Background: Regardless of the suspected cause of death, the post-mortem examination should always be done where deaths (related to sudden and unexpected demise), come under the jurisdiction to determine the cause and manner of the death. Various incidental findings are identified during microscopic examination which may or may not be the contributing factor for cause of death. This findings may have been a great learning tool for pathologists. So, an autopsy study of heart was conducted to find out the various histopathological changes.

Aims: To study the spectrum of histomorphological changes in heart in autopsies.

Materials and Methods: The study was conducted in the Department of Pathology, North Bengal medical college, West Bengal for a period of 2 years from August 2021 to August 2023. Total 143 autopsy specimen was received during this period, specimen of heart received were 139, 06 were autolysed. So 133 specimens of heart were examined macroscopically and microscopically to see the different histopathological findings.

Result: In our study most of the heart received in the age group of 21 -30 yrs. 72.1% cases showed fatty tissue interposition, 59.4% showed myocardial hypertrophy, 39.8% showed myocyte fibrosis, 31.57% showed inflammatory infiltration within myocyte, 22.5% showed atherosclerosis and thrombus within coronary vessels found in 6.7%.

Conclusion: The most common finding in our study is fatty tissue interposition within myocyte which differs from previous studies which showed atherosclerosis as the most common findings.

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1. Introduction

Coronary artery disease is a leading cause of death in both men and women representing 30% mortality in the world.¹ During the last five decades an increasing trend is seen in incidence of cardiac deaths especially among urban population. In India incidence of ischemic heart disease has increased to about 10 percent.^{2,3} Cardiovascular diseases are now became the leading cause of morbidity in India.⁴ One of the challenges is the inability to determine the cause of death and autopsies can be valuable source for providing valuable information regarding involved cardiac

pathology. Regardless of the suspected cause of death, the post mortem examination should always be done where death (related to sudden and unexpected demise), come under the jurisdiction to determine the cause and manner of the death. Various incidental findings are identified during microscopic examination which may or may not be the contributing factor for cause of the death. But these findings are great learning tool for cardiac Pathology for Pathologists, as chances of exposure to pathological changes in heart is very minimum, as we cannot get heart tissue otherwise except through endomyocardial biopsy or after Cardiac transplantation, which are not usually practiced in many centres. Though the autopsy could not

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describe the cause of death properly, many nonspecific findings with questionable causality to the occurred death are often reported.⁵ Many times it has been seen that gross pathology alone could not help to decide the cause of death, histomorphology can conclusively say the involved cardiac pathology if present.⁶ Of course, as of now, for Pathologist, in many Institutes, Forensic Autopsy can be the only source of getting specimen for study of different organs in normal and diseased state. Hence, this autopsy study of heart was conducted to study the various histomorphological features that may or may not be related to cause of death.

2. Aim

To study the spectrum of histomorphological changes in heart in autopsies, to get idea about various pathological changes involving heart, an organ, rarely we get exposed.

3. Materials and Methods

This study was conducted at Department of pathology , North Bengal Medical College and Hospital, West Bengal for a period of 2 years from August 2021 to August 2023. Total 143 medico legal autopsy specimens were received during this period from neighbouring 06 districts of North Bengal. Specimens of heart received were 139, of which 06 specimens were autolysed. So a total of 133 specimens of heart were examined macroscopically and microscopically to see the different histopathological findings.

3.1. Gross examination of heart

Formalin fixed specimens were inspected externally. Weight and dimension of whole heart were also recorded. The gross examination was done and external surface was examined for any gross pericardial pathology and any area of myocardial infarction (whether recent or old) was also noted if present.

The heart was opened by transverse (Short axis method) cut at mid-ventricular level followed by parallel transverse slices of ventricle 1 cm interval towards the apex . Measurement of thickness of right ventricular wall , left ventricular wall and interventricular septum were recorded. The valves were examined for their numbers , stenosis and calcifications, vegetations. Areas of recent or old myocardial ischaemia noted if present along with their location and sizes. All the three coronary arteries were examined using regular sections every 4-5 mm. The ascending aorta was checked for any dilatation, thickening and atheromatous plaque.

Sampling of Myocardium was taken by several transmural blocks circumferentially along the right ventricular wall, left ventricular wall and interventricular septum. Multiple sections from all the coronary arteries every 4 – 5 mm interval, aortal ring , bicuspid and tricuspid valve were also taken. In addition, sections were

taken from suspected pathological lesions. Photographic documentation was done at different steps. Tissues were processed and subjected to paraffin section and then were stained with routine Hematoxyllin and eosin stain and examined under light microscope by using 10X and 40X objectives and results were recorded.

4. Results

In the present study, 133 specimens of heart were included. Out of 133 specimens, 106 (79.69%) were of males and 27 (20.30%) were of females. Our study included cases of age between 10 - 80 years. In present study, it was observed that maximum number of cases were seen in the age group of 21-30 years i.e. 36(27.06%). (Figure 2)

On gross examination, the average weight of heart as measured in post-fixation state was 288.62 gms (minimum weight was 150 gms and maximum weight was 500 gms). As a whole biventricular hypertrophy was the commonest observation (50.63%), while specimens with Left ventricular hypertrophy (wall thickness > 1.5 cm) (Figure 1) predominated over specimens with right ventricular hypertrophy (wall thickness > 0.5 cm). (Table 1)

After histopathological examination, the most common finding is fatty tissue interposition within myocardium or myocardial adiposity in 96 cases (72.1%) followed by myocardial fibrosis in 53 cases (39.8%), inflammatory cell infiltration within myocardium in 42 cases (31.57%), atherosclerosis in 30 cases (22.5%) and thrombus within coronary vessels in 9 cases (6.7%), myocardial fibre disarray in 8 cases (06%) along with 1 case of endocarditis and pericarditis each (0.75%). To be mentioned as well that, the histopathological findings detailed above, were not isolated finding, rather more than one findings noted in each specimen. (Table 2)

Fatty tissue interposition is noted within left ventricular myocardium, epicardium and around coronary arteries (Pericoronary adipose tissue) in 17(17.7%) cases. (Figure 3) While in other 79(82.3%) specimens, fatty tissue was observed in mild to moderate grade in right ventricle.

Out of 42 cases of myocarditis, 24(57.14%) cases showed chronic inflammatory cell infiltration, 15(35.71%) cases showed acute inflammatory cell infiltration, and only 3(7.14%) cases showed eosinophilic infiltration (Table 3).

5. Discussion

In most of the Medical Institutes, specially of low resource type, autopsy with histopathological examination is the only way to study the different morphological changes in heart which is not possible in living and it helps the pathologists to find out the wide spectrum of histological features of heart in healthy individuals.

Keeping in mind that cardiac autopsy is helpful to reach the cause of death in cases of sudden death as documented

Table 1: Split-up of cases showing hypertrophy of the heart wall (n= 79)

S.No.	Heart wall involved	No of cases	% of cases
1.	Left ventricular hypertrophy	30	37.97
2.	Right ventricular hypertrophy	09	11.39
3.	Right and left ventricular hypertrophy	40	50.63
	Total	79	100

Table 2: Spectrum of histopathological findings

Findings	No. of cases (n=133)	Percentage
Fatty tissue interposition	96	72.1%
Myocardial hypertrophy	79	59.4%
Myocardial fibrosis (old healed infarct)	53	39.8%
myocarditis	42	31.57%
atherosclerosis	30	22.5%
Myocardial fibre disarray	08	06%
Thrombus within coronary vs endocarditis	09	6.7%
Pericarditis	01	0.75%
No specific findings	13	9.77%

Table 3: Distribution of myocarditis cases according to type of cell infiltration

Findings	No. of cases	Percentage
Acute inflammatory cell	15	35.71%
Eosinophilic cell infiltrate	03	7.14%
Chronic inflammatory cells	24	57.14%
	42	100

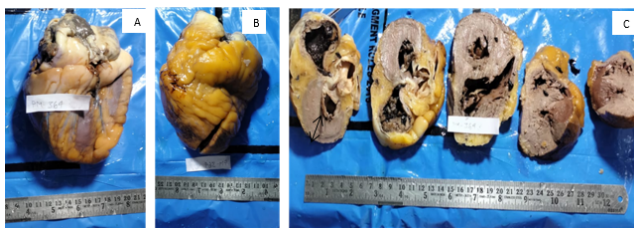


Figure 1: Gross view of the heart: **A:** Before short axis cross sectioning; **B:** Extensive epicardial fat; **C:** Transverse sections of the heart at different levels starting from the mid ventricle to apex. Increased left ventricular wall thickness > 1.5cm (Black arrow).

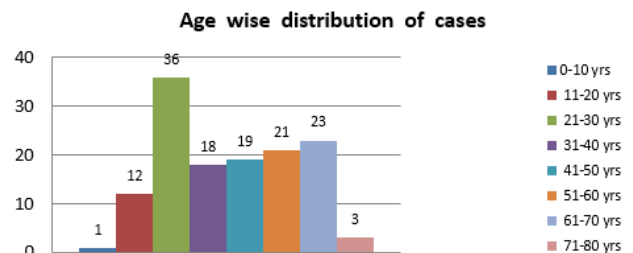


Figure 3: Age wise distribution of the cases

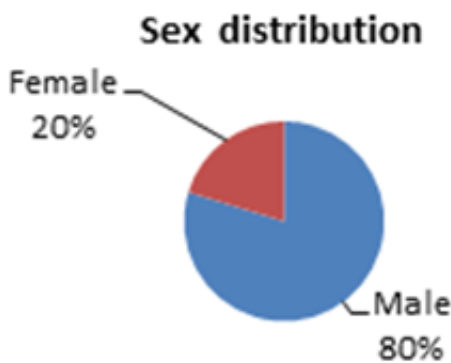


Figure 2: Sex distribution of cases

in published articles, our study was done with the aim to observe the different histomorphological features of heart that could guide us to find out the cause of death where there is no definite history of previous diseases or any comorbidities.

In the present study, nearly 80% of deceased were male as was observed in other study. The corresponding figures were 73% and 85.21% in their studies by Ozdemir B et al, and Joshi C et al, respectively.^{7,8}

In this study maximum number of cases were between 21 to 30 years (27.06%) that is one decade earlier than the study done by Agale V. Shubhangi et al.⁹

In gross examination, the average weight of heart in post fixation state was 288.62 gms whereas it was found to be

Distribution of fatty tissue infiltration within ventricle(n-96)

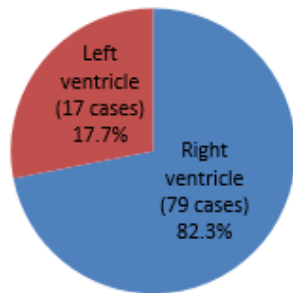


Figure 4: Distribution of fatty tissue infiltration within ventricles

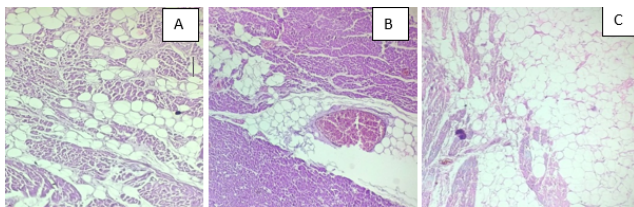


Figure 5: **A:** Fatty tissue interposition within left ventricular myocardium; **B:** Pericoronary adipose tissue (PAT); **C:** Increased epicardial fat.

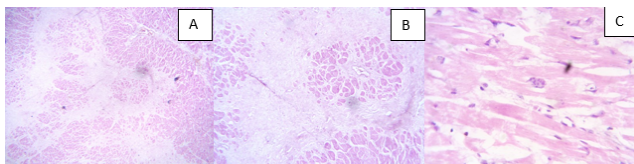


Figure 6: Patchy area of fibrosis within myocardium; **A:** Low power view; **B:** High power view; **C:** Hypertrophic cardiomyocyte.

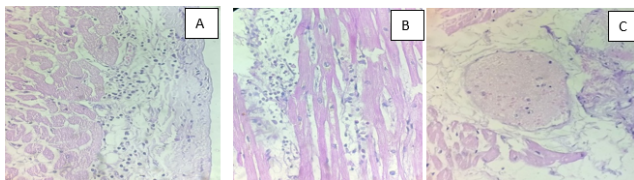


Figure 7: **A:** Endocarditis; **B:** Myocarditis; **C:** Thrombus within the myocardial vessels.

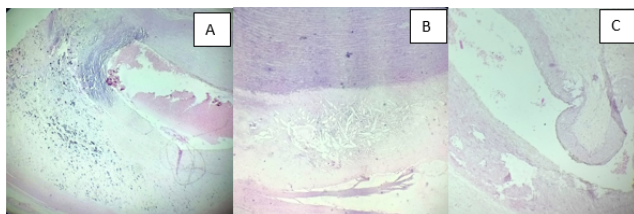


Figure 8: Atherosclerotic changes in coronary vessels

255 gms in a study done by Agale V. Shubhangi et al and 303.88 gms in a study conducted by Porwal et al.^{9,10}

Out of 133 cases, ventricular wall hypertrophy was found in 79 (59.39%) cases. Of the 79 cases biventricular hypertrophy found in 40 cases (50.63%) and left ventricular hypertrophy in 30 cases (37.97%). Joshi et al.⁸ also reported biventricular hypertrophy in 52% cases and left ventricular hypertrophy in 30% cases which is very similar to our study. Myocardial hypertrophy was also reported by Shanthi et al.,¹¹ Cristina Basso et al.,¹² and Bora et al.⁷ in their studies.

Histopathological examination revealed a wide spectrum of morphological changes like fatty tissue interposition within myocardium, myocardial fibrosis, myocarditis, atherosclerosis, myocardial fibre disarray and one case of endocarditis and pericarditis, but the most common finding was fatty tissue interposition within myocardial fibres found in 96 cases (72.1%) out of total 133 cases, which differs from previous studies that showed atherosclerosis as the most common findings like Garg et al (55.3%), Chandrakala Joshi (64%) and Ekta Rani et al (77.3%) have shown atherosclerosis to be the commonest finding in their studies.^{8,13,14}

Out of 96 cases of fatty tissue infiltration, 17.7% cases showed fatty tissue infiltration in left ventricle within myocardial fibres, pericoronary area and in epicardium. Physiological Cardiac fat mainly present in the right ventricle in more than 50% of healthy individual and only a small amount is found in left ventricular wall in the region of apex. This right ventricular fat increases with age, and its development is considered as a part of the aging process.¹⁵ In autopsy studies, cardiac fat is often seen in the right ventricle, with a frequency of up to 85%.¹⁶ In our study it is 82.3%. Bertaso et al. emphasized that the excessive amount of epicardial fatty tissue may lead to the accumulation of interstitial adipose tissue in the myocardium.¹⁷

In the present study, 53 cases (39.8%) showed patchy areas of myocardial fibrosis which can be due to old healed infarct or chronic ischaemic heart disease or post inflammatory as compared to 55% in a study by Joshi C and Rao DS reported 27.0% old infarcts.^{8,18}

Myocarditis was found in 42 (31.57%) cases as compared to 29% cases in a study by Kramer et al and 22% by Drory et al.^{19,20}

In this study 30 cases (22.5%) showed coronary atherosclerosis which is much lower than the other studies like Garg S et al showed 55.3%, Joshi C showed 64%.^{8,13}

6.7% cases showed thrombus in coronary vessels, very similar to studies by Joshi et al⁸ (5%), and Bora Ozdemir et al⁷ (4.8%).^{7,8}

06% cases show myocardial fibre disarray. Ahmad Mubara et al also showed myofibre disarray as a important and consistent pathological finding in their study.²¹

Similar to other studies, like Zijiao et al (6.1%) and Agale V. Shubhangi et al (22.49%), no specific findings observed on gross and in microscopy in 13 cases (9.77%) in this study.^{9,22}

6. Conclusions

Array of histomorphological changes can be documented from histopathological examination of autopsy specimens of heart. Many of them might point towards the cause of death. Histopathological examination of autopsy specimens of heart is valuable source for providing valuable information regarding involved cardiac pathology. Similar to other organ of body, fatty tissue interposition in myocardium appears to be independent prognostic marker in cardiac pathology. Coronary atherosclerosis, as documented to be the commonest observation by others, found to be much less in present study.

7. Limitations

Number of cases are low. Objective assessment of fatty tissue by morphometric analysis could have been more informative. All cases of unnatural death were included in study, limiting the establishment of relationship of cause of death in many cases.

8. Conflict of Interest

None.

9. Source of Funding

None.

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