



Histomorphological Analysis of Various Heart Diseases: An Autopsy Study

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Abstract

Background and Objectives: Cardiac autopsy is the main diagnostic tool to study various histomorphological changes in normal and diseased heart. Therefore, an autopsy study of heart was planned to observe various histomorphological cardiac changes, and to determine the incidence of heart disease in general population, in and around Nagpur city, to assess the role of histopathology as diagnostic tool to diagnose cardiac death and also to correlate the gross and microscopic findings in cardiac pathology.

Method: Total 200 hearts were systematically examined during two years of study period. Gross and microscopic findings on H and E stained sections were studied. The observations were divided into the following categories- 1) normal versus abnormal heart, 2) Congenital versus acquired anomalies, 3) Major versus minor cardiac findings.

Results: The incidence of heart disease in and around Nagpur city was found to be 28%. Cardiac pathology was 4 times more common in males than females. A major finding in this study was high frequency of atherosclerotic coronary heart disease (21.50%). The highest incidence of myocardial infarction was found in 31-60 years to the tune of 73%. In other cause of death such as drawing, hanging, poisoning, accident etc., there was no obvious cardiac pathology but in some cases incidental findings such as tunneled coronary artery, conal coronary artery, patent foramen ovale, high-tech off coronary ostium etc. were observed.

Conclusion: Myocardial infarction due to atherosclerosis is the commonest finding in death cases subjected to autopsy.

Keywords: Autopsy, Histomorphology, Histopathology, Cardiac pathology, Atherosclerosis, Myocardial infarction.

Introduction

Cardiovascular disease continues to be the single most common generic cause of sudden and unexpected deaths^[1]. Coronary heart disease has emerged as most common cause of sudden deaths

and affecting younger people as well as adults. About half of them had no previous clinical history and more than half of deaths were sudden or unexpected or both. Curiosity of society in cases where deaths is sudden presents crucial

social concern, thus to recognize natural deaths from unnatural deaths calls or investigations to cause of death^[2].

Almost most cases of sudden deaths are referred for autopsy. The main objective of the autopsy is establishment of final diagnosis and determination whenever possible, of the cause of death^[3]. It is reported that concordance between clinical and pathological cause of death are moderate and autopsy still provides a very important procedure for evaluating causes of death^[4]. Many a time, it has been found that when gross pathology could not help to evaluate the cause of death, histopathology can conclusively opine the involved cardiac pathology.

However the incidence of cardiac deaths has been increasing all over the world particularly in urban population during last five decades. In India incidence of ischaemic heart disease has increased to about 10%^[5]. Keeping in view such a high percentage of death rates due to heart disease in India, it is more than justified to undertake study in this area. Also Nagpur being centrally located and near composition culture, it is expected to render quite a realistic profile representative of population all over the country. The aim of present study was to evaluate and tabulated sequentially all gross cardiac findings in different types of deaths and microscopic findings in sudden deaths of cardiac origin.

Materials and Methods

The present study was conducted on two hundred autopsied hearts submitted for postmortem analysis in Department of Pathology, at Tertiary Care Hospital over a period of two years. Study also included the hearts sent by the Department of Forensic Medicine in case of medico legal cases. Hearts were examined in the Department of Forensic Medicine and sections were taken. The study was carried out randomly. The specimens were studied irrespective of age/sex and cause of death. Specimens showing decomposition and autolysis, because of delaying postmortem were excluded from the study. Epidemiological data

and post mortem findings were collected from the post mortem papers and police papers.

Gross examination of the heart

Weight and dimensions of whole heart were recorded. The external surface was looked for pericardial pathology and for evidence of recent or old infarct. The dissection of heart and coronary blood vessels was done by Virchow's method (following the direction of blood flow) mentioned in current method of autopsy practice by Ludwig^[6]. The size of the left ventricle and the right ventricle was assessed. The relation and relative size of the pulmonary artery and aorta was noted. The venous connections were also examined for any abnormality.

All gross findings as per pro-forma were recorded. Histological examination was performed on the hearts in cases where there was history of coronary heart diseases and/or gross findings suggestive of ischemic heart disease were present and served to confirm the gross diagnosis. The observations were divided into the following categories- 1) normal versus abnormal heart, 2) Congenital versus acquired anomalies, 3) Major versus minor cardiac findings

Microscopic examination

Sections were taken from right and left atrioventricular junction, right and left ventricular wall, interventricular septum, apex and multiple sections from all the coronary arteries. In addition, sections were taken from suspected pathological lesions. All sections were fixed in 10% neutral formalin for 1 to 3 days in automated tissue processor. The fixed tissue sections then were embedded in paraffin. Sections of 3 to 5 micrometer in thickness were cut and stained with haematoxylin and eosin^[7] and examined under light microscope by using 10x and 40x objectives and results were recorded.

Observations and Results

The present study comprises of 128 males and 72 females, from whom heart were taken and studied. There was remarkable male dominance. This series was consisted of cases between 0 ->70years

old. Maximum number of cases presented between the age group of 21-60years, (73%) followed by age group more than 60 years (11%), 11-20 years (10.5%) and age group of 0-10 years (5.5%).

28% (56 cases) of the deaths were diagnosed as cardiac in nature 53.50% were included in the

broad category of traumatic which encompassed accidents, homicides and suicides. The remaining causes were non-cardiac natural deaths (9.00%), sudden infant death syndrome (3.00%) and others (6.5%), as depicted in table 1.

Table 1: The general causes of death and their percentage

Cause of Death		No. of Males	No. of Females	Total Patients (%)
Accident		31	16	47 (23.50)
Burns		11	13	24 (12.00)
Drowning		06	06	12 (06.00)
Poisoning		05	05	10 (05.00)
Natural Deaths		12	06	18 (09.00)
Hanging and strangulation		09	05	14 (07.00)
Sudden infant death syndrome		03	03	06 (03.00)
Cardiac death	ACHD	42	11	56 (28.00)
	Floppy mitral valve	01	01	
	Mitral steonsis	01	00	
Others		07	06	13 (06.50)

Out of total 56 cardiac deaths, 53 consist of atherosclerotic coronary heart disease (ACHD) and it was a major finding of the study. Of the 53 ACHD, 26 were sudden and unexpected i.e. 55%.Acute myocardial infarction was more common in the age group of 21-50 years while

chronic myocardic infarction in between 31-60 years. The highest incidence of overall myocardial infarction was found in 31-60 years to the tune of 73%.The histopathological cardiac findings were shown in table 2.

Table 2: Major and Minor Congenital and Acquired Cardiac Findings

Cardiac Findings		No. of Patients	Percentage
Major Congenital	Floppy Mitral Valve	02	01.00
Minor Congenital	Tunneled Coronary Artery	02	01.00
	Conal Coronary Artery	03	01.50
	Patent Foramen Ovale	03	01.50
	High-Tech Off Coronary Ostium	04	02.00
Major Acquired	ACHD	53	21.05
	Cardiac Trauma	04	02.00
	Valvular Heart Disease	01	00.50
Minor Acquired	Cardiac Adiposity	56	23.00
	Left Ventricular Hypertrophy	38	19.00
	Right Ventricular Hypertrophy	18	09.00

Morphological observations including both gross and microscopic features of 53 subjects with atherosclerotic coronary heart disease were shown in table 3.

Table 3: Distribution of 53 cases of ACHD in relation with the age of infarction depending on the morphological parameters

Morphological Features		Gross Appearance		No. of cases	Percentage	
		Present	Absent			
Group- Acute Recent	I and	Waviness of fibres	--	--	07	00-1/2
		Waviness of fibres+ Contraction band	--	--	04	01-02 (Hrs)
		Waviness of fibres + edema + eosinophilia of fibres	--	--	05	04-12 (Hrs)
		Waviness of fibres + edema + few neutrophils	Pallor 07	03	10	18-24 (Hrs)
		Total coagulation necrosis	Pallor with Hyperemia 03	--	03	24-72 (Hrs)
Group Chronic Old	II and	Cellular disintegration + fibrovascular response	Yellow, soft central area with red brown margin 06	--	06	10 days
		Granulation tissue with fibrous tissue	Yellow, white scar 08	--	08	07 weeks
		Abundant collagen + scanty fibrous tissue	White scar 10	--	10	>07 weeks

There were 29 fresh and 24 healed infarctions as shown in table 4. The gross features of fresh myocardial infarction and high-tech off coronary ostium were depicted in figure 1. In histopathological evaluation most, common finding was atherosclerosis (Figure 2) followed by

myocardial infarction (Figure 3). 49% of the infarctions were located in the anterior region (including Apex), 28.31% in posterior region, and 11.32% each in lateral and circumferential region. The frequency of posterior healed infarcts was more than posterior fresh one.

Table 4: Association of Gross and Histopathological Features of Myocardial Infarction at Autopsy

Type of Infarct	No. of Cases	Gross Features S/O Infarction		Microscopic Features of Infarction	
		Present	Absent	Present	Absent
Fresh infarction (Acute and Early)	29	10	19	29	00
Healed infarction (Chronic and Old)	24	24	00	24	00
Total	53	34	19	53	00

Figure 1: a) Gross showing features of fresh myocardial infarction and b) Gross showing high-tech off coronary ostium

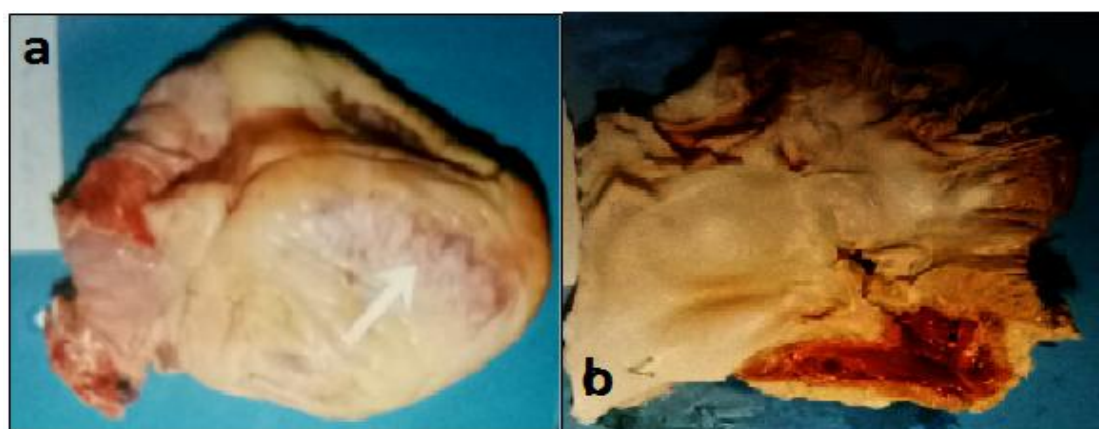


Figure 2: a) H and E stained section through coronary shows atherosclerosis with rupture and calcification × 100, b) H and E stained section showing atherosclerosis with heavy calcification × 100

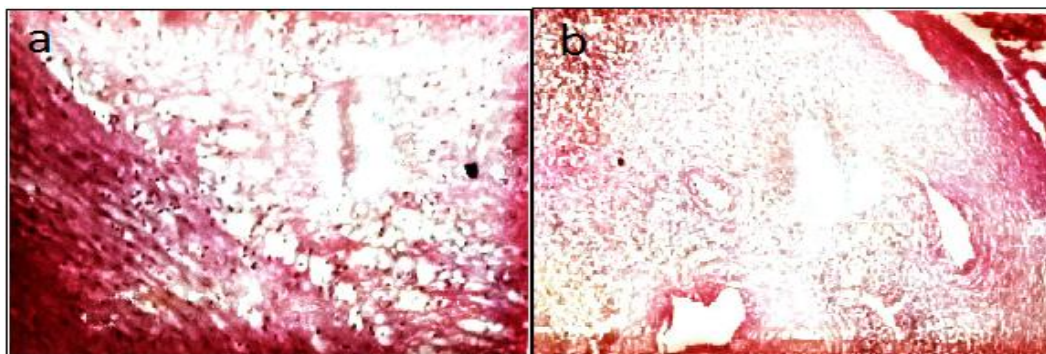
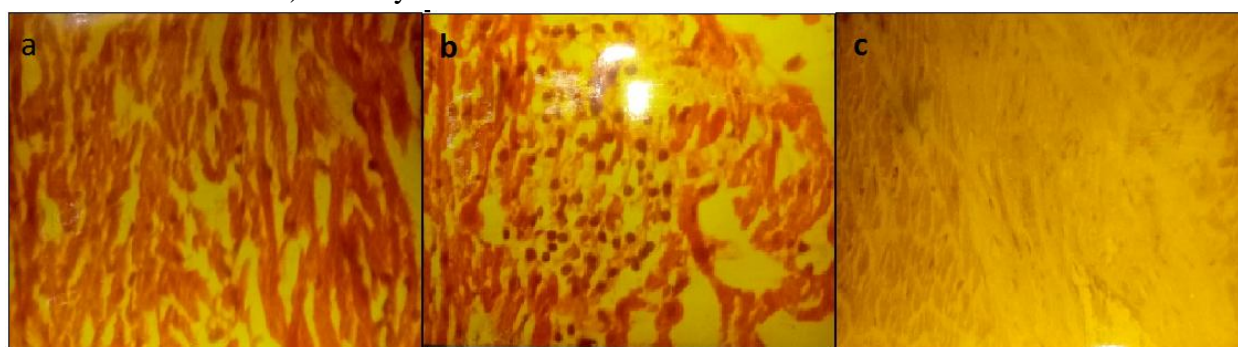


Figure 3: H and E stained section shows features of a) Recent Myocardial Infarction, b) Chronic Myocardial Infarction and c) Old Myocardial Infarction × 400



Out of 53 subjects with ACHD, in 37 cases complete or nearly complete occlusion (75% or >75%) was noted, this account for 69.8%, 50-75% occlusion was noted in 04 cases and <50% in 06 cases, 06 cases were without occlusion. Out of 53

patients, 32 were categorized as sudden unexpected death and 21 as sudden expected death differences between these cases were shown in table 5.

Table 5: Significant Differences between Cases with Sudden Expected Death and Sudden Unexpected Deaths

	Sudden Unexpected Deaths		Sudden Expected Deaths	
	No.	%	No.	%
>75% Stenosis	20	62.50	17	80.00
>1 Vessel involvement	04	12.50	05	23.80
Heart Weight > 500 gm.	16	50.00	18	85.71
Occlusive Thrombosis	08	25.00	05	23.80
Fibrosis	06	18.75	18	85.71

No specific major cardiac pathology was observed in the subjects with other causes of death such as drawing, burn, hanging, poisoning, accident etc. but in some cases minor congenital cardiac findings such as tunneled coronary artery, conal coronary artery, patent foramen ovale, high-tech off coronary ostium, (Figure 1b) were observed.

Discussion

Keeping in mind the main aim of the autopsypathologist isto help to reach the cause of death and cardiovascular causes being the most common one as mentioned in literature, the cardiac autopsies were performed with the aim to observe histomorphological spectrum that could guide and solve the mystery of death, especially

sudden death^[3]. The major goal of the present study was to focus on cardiovascular findings in a group of subjects whose corpses were subjected to medico-legal examination. The case loads in this study significantly overrepresented males and may result in this study in the under-representation of any pathologic conditions that are more prevalent in females. This type of gender distribution has been seen in other forensic autopsy studies^[8-10]. In present study, most of cardiovascular deaths occurred within age range of 31-60 years. Similar findings were reported in other studies^[4,11]. This shows that age is a powerful risk factor for heart disease. Cardiac deaths accounted for 28% of the study population; this was compared with previous studies^[1,12]. But as the cases were selected randomly, the incidence of cardiac death in the study population may over-represent. Thus, without 100% post-mortem rate an accurate assessment of the incidence of cardiovascular disease or for that matter of any disease process is very difficult.

The major finding of the study was high frequency of atherosclerotic heart diseases (21.50%). 1% incidence of floppy mitral valve was quite low as compared with general incidence of this condition, that was 5-10% mentioned in the standard literature. The incidence of various congenital minor findings such as tunneled coronary artery, conal coronary artery, patent foramen ovale, high-tach off coronary ostium was found to be 1-2% each. This was very low as compared to various studies mentioned in the review of literature. The infarcts were classified on the basis of age as fresh (both acute and recent) and healed (both chronic and old) infarcts. 29 fresh and 24 healed infarcts were noted. The difference in the frequencies of fresh and healed infarcts of the same location was noted, posterior infarcts with a better survival following the acute episode, figures to a much higher frequency in the healed state (33%). 69.8% of the coronary occlusion in myocardial infarction was noted. We also studied myocardial infarction and coronary occlusion, on the parameter whether they

positively correlated with one another or not. The positive correlation with respect to fresh myocardial infarction to the tune of 80% was observed which was same with that of Bhusnurmah et al^[13]. Pertaining to healed myocardial infarction the positive correlation was observed in 68.75% of cases which was somewhat less as compared to the Bhusnurmah et al^[13] study, in this it was 76%.

Sudden expected death subjects showed a significant divergence, particularly in respect of 1) A higher incidence of myocardial fibrosis, 2) A greater frequency of pathologic heart weight (Heart weight 500 or > 500 gm) and 3) A higher frequency of maximum degree of stenosis. These results were comparable with that of study of Baroldi et al^[14]. These findings associated with the presence of symptoms in their history may indicate that sudden expected death subjects were more chronic subjects in whom both myocardial fibrosis and pathological heart weight may be the result of chronic sympathetic disturbances.

Conclusion

In present study most common cause of death is myocardial infarction due to atherosclerosis. Histopathological studies provide the most accurate clues to a better understanding of human cardiovascular diseases. With better insight into disease pathophysiology, novel interventions could be introduced to improve care and future outcomes for patients undergoing cardiovascular diseases.

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