Autopsy Study of Heart with special emphasis on coronary artery lesions

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ABSTRACT

Aims and objectives: Establishments of relation between various patients' factors (age, sex) with various histo-pathological pattern of hearts as well as analyse the histomorphological pattern of Coronary artery lesions in Heart. **Materials and Method:** The heart with the aorta was removed from the body and studied in detail. The heart was examined externally to note the size, weight, fat deposition, course of coronary arteries, thickening of coronaries, scars etc. Gross examination of the walls for the presence of Infarct, the thickness of the ventricular walls and inter-ventricular septum were recorded. The aorta, right and left coronary arteries were examined for atherosclerosis, aneurysmal dilatation and congenital abnormalities. Tissue bits were taken for microscopic study from both ventricles, representative sections from right coronary artery, left anterior descending artery and left circumflex branch of left coronary artery, from inter-ventricular septum, apex and from aorta. **Results & Conclusion:** In the present study, the atherosclerosis of coronary artery disease was the most frequently encountered lesion contributing to death. Males were affected more frequently than the females by atherosclerotic coronary artery disease. Left anterior descending branch of left coronary artery is the most commonly involved in atherosclerosis. In cases of Ischaemic Heart Disease triple vessel disease was found predominantly.

Key words: Autopsy of Heart, Coronary artery lesions, Histo-morphological pattern of Heart, Myocardial Infarction.

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Conflict of interest: None

INTRODUCTION

The human heart is a remarkably efficient, durable and reliable pump that propels over 6000L of blood through the body daily during an individual's lifetime, thereby providing the tissues with a steady supply of vital nutrients and facilitating the excretion of waste products [1]. IHD is the leading cause of death worldwide for both male and female [1] .

The occurrence of IHD in developing countries is a decade earlier compared with the age incidence in developed countries [2]. The main objective of the autopsy is establishment of final diagnosis and determination whenever possible the cause of death. Cardiovascular diseases account for 56% of all natural causes of sudden death. Coronary (ischemic) heart disease accounts for more than 75% of sudden cardiac death [2]. A detailed gross study of the heart with photographic records, and histological analysis is still the gold standard against which ante mortem cardiologic findings are measured.

Thus, a random study of autopsy cases who died either due to heart disease or died of a cause unrelated to heart disease and in which the cause of death was unknown was done to evaluate the incidence of various types of heart diseases and relative frequency of these diseases accounting for the death in this setup.

AIMS AND OBJECTIVES:

Establishments of relation between various patient's factors (age, sex) with various histo-pathological pattern of heart as well as analyse the histomorphological pattern of Coronary artery lesions in Heart.

METHODOLOGY

After approval by ethical committee the study was carried out. Autopsy specimen of Hearts sent from the forensic department of Sir T Hospital to the department of Pathology, Govt. Medical College, Bhavnagar which fitted in the inclusion criteria of the study.

Details of the cases were entered in a Performa prepared for the study. The heart with the aorta was removed from the body and studied in detail. All the hearts with aorta were fixed in 10% formalin. Relation of the great vessels was noted, any variations recorded. The heart was examined externally to note the size, weight, fat deposition, course of coronary arteries, thickening of coronaries, scars etc.

The heart was then cut open along the flow of blood as described by Virchow. Gross examination of the walls for the presence of Infarct. Photographs were taken after dissection if any lesions were found. After complete dissection, the thickness of the ventricular walls and interventricular septum were recorded. The aorta, right and left coronary arteries were examined for atherosclerosis, aneurysmal dilatation and congenital abnormalities.

Tissue bits were taken for microscopic study from both ventricles, representative sections from right coronary artery, left anterior descending artery and left circumflex branch of left coronary artery, from inter-ventricular septum, apex and from aorta. Additional bits were taken from any gross pathological lesion found. Tissues selected for histopathological examination were processed routinely, paraffin blocks were prepared and 3 to 6 micron thick sections were cut and stained with hematoxylin and eosin. The sections were studied and correlation of gross and microscopic findings was made.

OBSERVATION & RESULTS:

The present study was done on 100 specimens of hearts of autopsies sent to the pathology department from forensic department fitted into the inclusion criteria of the study.

The ages ranged from 11 years to 90 years. Majority of cases were seen in the age group 51-60 years (28 cases i.e. 28%) and 31-40 years (21 cases i.e. 21%) followed by 61-70 years (19 cases i.e. 19%). 41-50 years (17 cases, i.e. 17%) and 21-30 years (8 cases i.e. 8%). Rarely affects extremes of age group as 3 cases in 11-20 years group, 3 cases in 71-80 years group and 2 cases 81-90 years group. Males were affected more frequently (83 cases i.e. 83%) than females (17 cases i.e. 17%). The M/F ratio was 4.88:1 (Table 1).

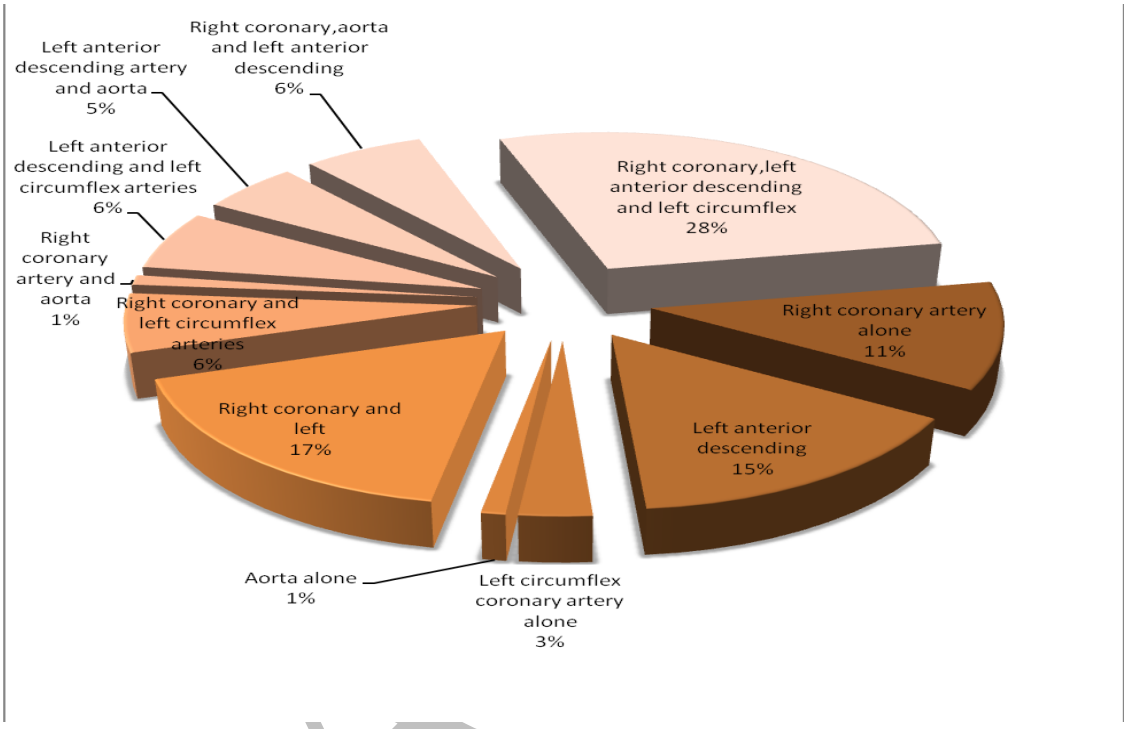
Table 1: Age and sex distribution of cases

Age groups (yrs)	11-20		21-30		31-40		41-50		51-60		61-70		71-80		81-90	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	2	1	4	4	19	2	16	1	24	4	15	4	2	1	1	0
No of Cases (Total 100)	3 (3%)		8 (8%)		21 (21%)		17 (17%)		28 (28%)		19 (19%)		3 (3%)		1 (1%)	

Out of 100 cases, in 98 cases of atherosclerotic changes in coronary arteries and aorta were found. The lesions found were fixed coronary obstruction, thrombus, complicated atherosclerotic plaque and acute and healed myocardial infarction.

The age group ranged from 11 years to 90 years. Majority of the cases were seen in the age group 51-60 years (28 cases i.e. 28%) followed by 31-40 years (20 cases i.e. 20.4%), 41-50 years (17 cases, i.e. 17%), 61-70 years (19 cases i.e. 19.3%), 71-80 years (3 cases i.e. 3%), 11-20 years (2 cases i.e. 2%) and 81-90 years (1 case i.e. 1%) . Males were affected more frequently (82 cases i.e. 83.67%) than females (16 cases i.e. 16.32%). The M/F ratio was 5.1:1.

Graph No.1: Incidence of Involvement of Coronary Arteries and aorta in Atherosclerosis



As shown in graph the combined involvement of right coronary, left circumflex and left anterior descending arteries was seen in 27 cases (27.55%) and left anterior descending artery alone in 15cases (15.30%)

Table 2: Combined involvement of coronary arteries by atherosclerosis			
Sr.no	No of coronary vessels involved	No. of cases(97)	Percentage
1.	Single Vessel Disease(SVD)	35	36.08%
2.	Double Vessel Disease(DVD)	35	36.08%
3.	Triple Vessel Disease(TVD)	27	27.83%

Table:3 Frequency of involvement of individual vessel by atherosclerosis			
Sr.no	**Coronary arteries**	**Number of cases(98)**	**Percentage**
1.	Right coronary artery	67	68.36%
2.	Left anterior descending coronary artery	75	76.53%
3.	Left circumflex artery	42	42.85%
4.	Aorta	21	21.42%

Left Anterior Descending Coronary artery involvement occur in 75 cases (76.53%) followed by Left Coronary artery in 70 cases (71.42%) and Right Coronary Artery in 67 cases (68.36%).

Ischemic Heart Disease:

Out of 98 cases of atherosclerotic coronary artery disease, ischemic heart disease was encountered in 39 cases (39.79%). The age groups ranged from 11 to 90 years. Majority of the cases were seen in age group of 51 to 60 years, 13 cases (33.33%). Males were affected predominantly in 35 cases (89.74%) and females in 4 cases (10.25%). In 41.02% of the cases of myocardial infarction triple vessel disease was seen followed by 30.76% of cases of double vessel disease, followed by 25.64% of cases of single vessel disease.

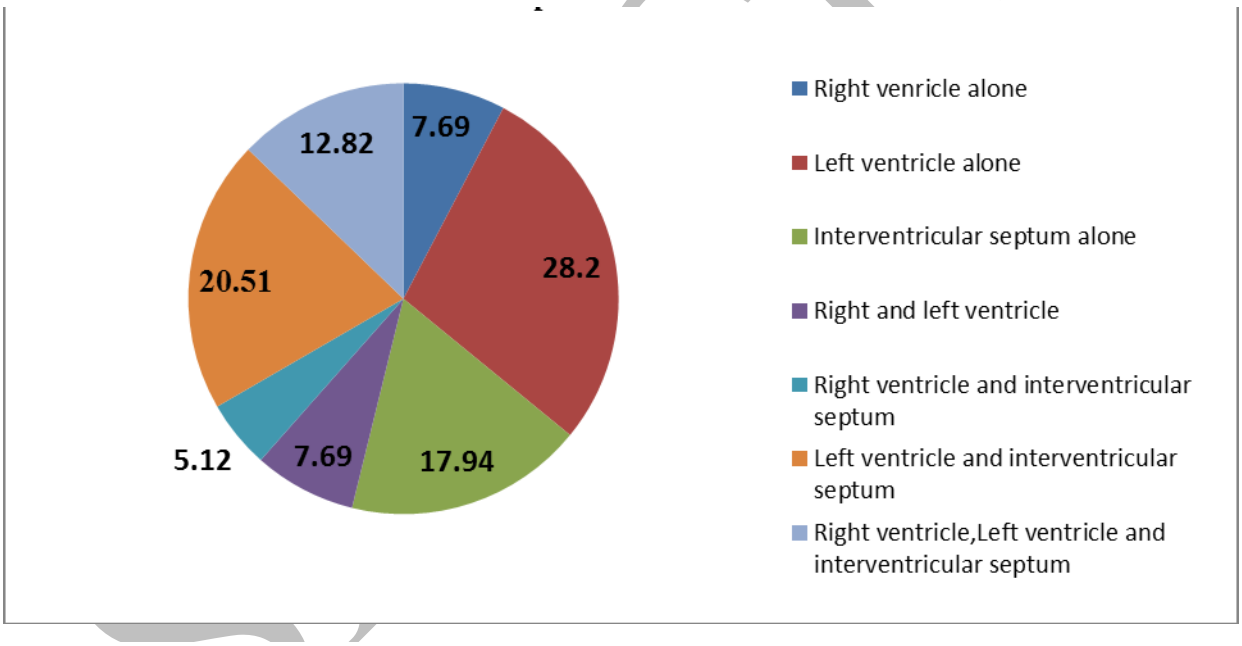
Table:4 Incidence of no. of coronary vessels involved by atherosclerosis in cases of myocardial infarction

Sr.no	**Coronary arteries**	**No. of cases(39)**	**Percentage**
1.	No artery involved	1	2.56%
2.	Single Vessel	10	25.64%
3.	Double Vessel	12	30.76%
4.	Triple Vessel	16	41.02%

In 41.02% of the cases of myocardial infarction triple vessel disease was seen followed by 30.76% of cases of double vessel disease, followed by 25.64% of cases of single vessel disease.

The involvement of left ventricle alone was seen predominantly in 11 cases (28.20%) followed by combined involvement of the left ventricle and inter-ventricluar septum was seen in 5 cases (12..82%). In left ventricle, apex is involved in 21 cases (77.77%) and base in 16cases (59.29%) from total 27 cases in which left ventricle was involved. Recent infarction was seen in 34 cases (87.17%) followed by old infarcts in 3 cases (7.69%).

Graph No.2: Involvement of right ventricle, left ventricle and interventricular septum in ischemic heart disease



Graph No.2: Involvement of right ventricle, left ventricle and interventricular septum in ischemic heart disease

DISCUSSION

Cardiovascular diseases are an important cause of morbidity and mortality both in developed and developing countries. The incidence of cardiovascular diseases is greater in urban areas than in rural areas reflecting the acquisition of several risk factors such as tobacco consumption, lack of physical activity, unhealthy diet and obesity. A peculiar cause of concern is the relative early age of cardiovascular deaths in the developing countries. According to projections, in India, the number of deaths due to ischemic heart disease was to increase from 1.59 million in 2000 to 2.03 million in 2010.

Table No: 5 Comparison of the age distribution of cases in various studies

Present Study (2013-2014)	**Age groups (yrs)**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**
	No of Cases (Total 100)	3 (3%)	8 (8%)	21 (21%)	17 (17%)	28 (28%)	19 (19%)	3 (3%)	1 (1%)
Kech [61] (2006-2008)	Age groups (yrs)	11-20	21-30	31-40	41-50	51-60	61 and above		
	No of Cases (Total 120)	7 (5.83%)	24 (20%)	26 (21.66%)	19 (15.83%)	19 (15.83%)	25 (20.83%)		
Kasturi [8] (2002)	**Age groups (yrs)**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**
	No of Cases (Total 13)	0 (0%)	2 (15.38%)	6 (46.15%)	5 (38.46%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

The ages ranged from 11 years to 90 years. Majority of cases were seen in the age group 51-60 years (28 cases i.e. 28%) and 31-40 years (21 cases i.e. 21%) followed by 61-70 years (19 cases i.e. 19%). 41-50 years (17 cases, i.e. 17%) and 21-30 years (8 cases i.e. 8%). Rarely affects extremes of age group as 3 cases in 11-20 years group, 3 cases in 71-80 years group and 2 cases 81-90 years group.

In Keche [61] study majority of cases were seen in 31-40,(26 cases) and then in 60 years and above,(25 cases)age groups from 11-20 years shows minimum number of cases that is 7 cases.In the study by Kasthuri [8]majority of cases were seen in 31 to 40 years (6 cases) and 41 to 50 years (5 cases). In present study Males were affected more frequently (82 cases i.e. 82%) than females (18 cases i.e. 18%). The M/F ratio was 4.55:1 . In the study by Kasthuri[2] 100% of cases were males. In Singh[5] study 85% and 15% females.

In Davies[4] study 65% males and 41% females were found. InBhargava[7] study majority 74.8% were males and 24.2% were females. In Keche[9] and in Garg[8] study percentage of males and females were 75% and 25% and 80.9% and 19.1. In Murthy[10] majority of cases 82% were males and 18% were females. In all studies males are affected more frequently than in females.

Table No : 6 Comparison of incidence of Coronary Atherosclerosis by various Author		
Authors	**Total No of Cases Studied**	**Incidence of coronary atherosclerosis (%)**
Present study (2013-2014)	100	98%
Kasthuri[2] (2002)	13	84.6%
Singh[5](2005)	200	78%
Padmavati[12](1968)	555	67.3%

In the present study the single vessel disease and double vessel disease was encountered more frequently considering all the cases compare to the study by Kasthuri and Mumtaz Some observers attribute geographic, racial and sex differences in the incidence of myocardial infarction to differences in the severity of arterial atherosclerosis, others suggested that the modern epidemic of ischemic heart disease may be due to primarily to an increased tendency to thrombosis.

Table No :7 Comparison of combined involvement of coronary arteries by atherosclerosis by various authors			
No. of coronary vessels involved	**Authors and No of cases**		
	Present study (97)	**Kasthuri[2] (11)**	**Mumtaz[11](66)**
Single Vessel Disease(SVD)	35 (36.08%)	1(9.09%)	10(15.15%)
Double Vessel Disease(DVD)	35 (36.08%)	2(18.18%)	15(22.72%)
Triple Vessel Disease(TVD)	27 (27.55)	8(72.7%)	27(40.90%)

In the present study incidence of ischemic heart disease was 39.79%. The incidence of triple vessel disease was more than double and single vessel disease in cases of myocardial infarction, but considering all cases the incidence of double and single vessel was more.

Already it has been mentioned that the frequency of acute myocardial infarction in sudden coronary death patients ranges from 0 to 46% which is dependent on the definition used for sudden death. In the present study, majority of cases of IHD were seen in the age group of 51 to 60 years. Males were affected predominantly in 35 cases (89.74%) and females in 4 cases (10.25%).

Though 98 cases of atherosclerotic coronary artery disease were seen out of 100 cases, frank myocardial infarction was seen in only few cases. This may be due to the fact that sudden death is most often due to ventricular fibrillation caused by myocardial irritability induced by ischemia or infarction[3]. In the setting of significant coronary artery atherosclerosis and no frank infarction changes in the heart, arrhythmia related to acute ischemia is the likely cause of sudden death. In patients with healed infarcts, new ischemia is the major cause of ventricular arrhythmia leading to sudden death[3].

Table No :8 Comparison of the incidence of myocardial infarction in various studies

Study	**Total No. of cases**	**No. of cases of myocardial infarction**
Present study (2013-2014)	100	39(39.79%)
Garg[8](2011)	115	26(26.8%)

In the present study left ventricle was involved predominantly in 11 cases, followed by left ventricle and interventricularseptum.In Henry[5] study left ventricle alone is involved predominantly in 60 cases(61.8%) followed by combined involvement of left and right ventricle

Table No :9 Comparison of involvement of right, left ventricle and interventricular septum in IHD by various authors

Wall involved	Present study No. of cases (39)	Henry[4] No.of cases (97)
Right venricle alone	3(7.69%)	3(3.1%)
Left ventricle alone	11(28.20%)	60(61.8%)
Interventricular septum alone	07(17.94%)	4(4.1%)
Right and left ventricle	03(7.69%)	13(13.4%)
Right ventricle and interventricular septum	02(5.12%)	0(0%)
Left ventricle and interventricular septum	08(20.51%)	0(0%)
Right ventricle,Left ventricle and interventricular septum	05(12.82%)	5(5.1%)

The evidence suggested that coronary atherosclerosis directly predisposes to occlusion by thrombosis and thereby to ischemic heart disease. Patients dying from ischemic heart disease had a consistently higher mean extent of atherosclerotic lesions

than accidental death cases or other natural death cases, but the ranges of the coronary and non coronary death cases overlapped. Ischemic heart disease did occur with coronary lesions less extensive than the means of accidental death cases, but this occurrence was rare.

The important differences in coronary lesions developed very early in life and at least 20 years before the onset of manifest clinical disease. The search for etiologic factors responsible for coronary atherosclerotic lesions should therefore be concentrated on this earlier period of life.

Most investigators accepted the premise that the fatty streak was the earliest identifiable lesion of atherosclerosis, and that some fatty streaks progressed into fibrous plaques and other more serious atherosclerotic lesions. On the other hand, some evidence suggested that intimal fat deposition was an independent phenomenon unrelated to clinically significant atherosclerosis.

McGill[13] analyzed in overall pool of data extracted from grading of 23,207 sets of coronary arteries contributed from 14 countries to a central laboratory. Fatty streaks in the aorta increase rapidly in succeeding age groups during the third decade. Fibrous plaques and other advanced lesions approaches similar degrees of extent 20 years or more lately.

Fatty streaks in the coronary arteries increase more slowly in the second and third decades of life, and show no tendency to regress at any age. These data are consistent with hypothesis that advanced atherosclerotic lesions develop by progression and transformation of fatty streaks.

Strong[14] studied a total of 2876 subjects, between 15 and 34 years old, black and white, men and women, who died of external causes and underwent autopsy to document the extent and severity of atherosclerosis in adolescents and young adults in the United States. They found that intimal lesions appeared in the aortas and more than half of the right coronary arteries of the youngest age group 15-19 years and increased in prevalence and extent with age through the oldest age group 30-35 years. Raised lesions in the aortas of women and men were similar, but raised lesions in the right coronary arteries of women were less

than those of men. The prevalence of total lesions was lower in the right coronary artery than in the aorta, but the proportion of raised lesions among total lesions was higher in the right coronary artery than in the aorta.

Atherosclerosis begins in youth. Primary prevention of atherosclerosis, as contrasted with primary revelation of clinically manifest atherosclerotic disease, must begin in childhood or adolescence.

CONCLUSION

Atherosclerosis of coronary artery disease is the most frequently encountered lesion contributing to death. Males are affected more frequently than the females by atherosclerotic coronary artery disease. In cases of Ischemic Heart Disease triple vessel disease was found predominantly. Left anterior descending branch of left coronary artery is the most commonly involved in atherosclerosis.

SUMMARY

- The present study was undertaken on 100 hearts with aorta sent to the Pathology department, Govt. Medical College & Sir.T Hospital Bhavnagar,from the Forensic Department in 10% formalin,with properly filled autopsy form containing the details of the deceased.
- The ages ranged from 11 years to 90 years. Majority of cases were seen in the age group 51-60 years (28 cases i.e. 28%).
- Males were affected more frequently (83 cases i.e. 83%) than females (17 cases i.e. 17%). The M/F ratio was 4.88:1.
- Out of 100 studied cases, 98% showed the presence of atherosclerosis.
- The combined involvement of right coronary, left circumflex and left anterior descending arteries was seen in 27 cases (27.55%) and left anterior descending artery alone in 15cases (15.30%).
- The incidence of Single & Double Vessel Disease was equal 35 cases (36.08%) followed by triple vessel disease in 27 cases (27.55%).
- Left Anterior Descending Coronary artery involvement occur in 75 cases (76.53%) followed by Left Coronary artery in 70 cases (71.42%) and Right

Coronary Artery in 67 cases (68.36%).

- Out of 98 cases of atherosclerotic coronary artery disease, ischemic heart disease was encountered in 39 cases (39.79%).
- The age groups ranged from 11 to 90 years. Majority of the cases were seen in age group of 51 to 60 years, 13 cases (33.33%). Males were affected predominantly in 35 cases (89.74%) and females in 4 cases (10.25%).
- In 41.02% of the cases of myocardial infarction triple vessel disease was present and in 30.76% of cases double vessel disease was seen followed by 25.64% of cases of single vessel disease.
- In cases of myocardial infarction left ventricle alone was seen predominantly in 11 cases (28.20%) followed by combined involvement of the left ventricle and interventricluar septum in 5 cases (12..82%). In left ventricle, apex was involved in 21 cases (77.77%) and base in 16cases (59.29%) from total 27 cases in which left ventricle was involved.
- In the study cases of both recent and old infarct was seen.Recent infarction was seen in 34 cases (87.17%) followed by old infarcts in 3 cases (7.69%).

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Case Record Form (CRF)

"Autopsy study of Heart with special emphasis on Coronary Artery lesions"

Principal Investigator: Dr.Nasrin Qureshi, Dept.of Pathology.

Co-Investigator:1.Dr.S.K.Suri,Professor and Head, Dept.of Pathology.

2. Dr.A.P.Parmar, Associate Professor& I/C Head, Dept.of Forensic Medicine.

3. Dr.ShwetaAmarneel, 2nd Year Resident, Dept.of Pathology.

Sponsor : Dept. of Pathology, Sir Takhtsinhji General Hospital & Govt. Medical College, Bhavnagar.

IRB Approval No……../2014 ……..

Autopsy no. : **Date:**

Name: **Age and sex:**

Inclusion criteria

Sr.No.	*Please mark '√' for the appropriate option*	Yes	No
1.	Cause of Death not known		
2.	Known case of Cardiac disease		

Exclusion Criteria

1.	Proved non cardiac cause for death		

Brief history:----------

Smoking History (if known):----------

Any prodromal signs and symptoms such as chest pain and palpitation before death:--------

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Gross examination of Heart:

- **Weight of the heart:----------Kg**
- **Dimension of Heart:----------cm**
- **Right Ventricular wall measurement :----------cm**
- **Left Ventricular wall(Apex) measurement:----------cm**
- **Left Ventricular wall(Base) measurement:----------cm**
- **Coronary atherosclerosis(grading) :--------degree of atherosclerosis**
- **Recent or old infarcts along with their size and location:----------**

- **Thickness of intenventricular septum:----------cm**

Histological findings:

Grading of coronary artery lesions

Mild degree of Atherosclerosis	**Moderate degree of Atherosclerosis**	**Severe degree of Atherosclerosis**

Vessel Involvement

Single vessel Involvement	Double vessel Involvement	Triple vessel Involvement

Changes of Infarction

Changes of Infarction and Congestion	Left Ventricular Wall	Right Ventricular wall	Apex	Interventricular septum
Infarct				