Study of Coronary Atherosclerosis and Myocardial Infarction in Medico Legal Autopsies from Central India

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ABSTRACT

BACKGROUND

Autopsy is of great importance in collecting precise data for the evaluation of the health care, research and for providing material for education. Atherosclerosis is a chronic inflammatory disease causing more morbidity and mortality in developed as well as in developing countries. In Indians, atherosclerotic lesions occur 10 to 15 years earlier and the lesions are in the advanced stage. It is difficult and expensive to evaluate the atherosclerotic lesions in the living subjects. Autopsy based studies are very crucial in studying the atherosclerotic lesions. The present study was undertaken with the aim to study, the presence of atherosclerosis in the coronary vessels in autopsy cases and to correlate it with age and sex.

METHODS

This is a prospective observational study from Central India. Dissected heart specimens with coronaries were studied irrespective of the age and sex.

RESULTS

In the present study, 407 cases were studied. There was a male preponderance, accounting for 311 (76.5%) cases. There was no case of atherosclerosis below 20 years of age. Total 209 (51.35%) cases showed atherosclerosis, out of which 170 (81.33%) were males. Left anterior descending coronary artery was most commonly involved. Triple vessel involvement was most commonly seen (70.82% cases). Infarction was seen in 54 (13.26%) cases; two cases showed infarct at the age of 21 years.

CONCLUSIONS

Coronary atherosclerosis was seen in 51.35% of cases starting at an early age of 21 years. There was a male predominance. The left anterior descending coronary artery was the most common coronary artery involved.

KEYWORDS

Autopsy, Coronary Atherosclerosis, Heart, Left Anterior Descending Artery, Myocardial Infarction, Triple Vessel Disease

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BACKGROUND

Autopsia, is a Greek word meaning "to see for oneself", from which the term autopsy is derived. An autopsy is an accepted part of medicine and is of great importance in contributing precise data for the evaluation of the health care, research and development in medical science and providing material for education. There was a decline in the rate of autopsies performed in the 20th century. An autopsy has its own many pitfalls and constrains.[1] Karl Rokitansky is regarded as the father of modern autopsy. Karl has emphasized the importance of examination of each organ regardless of the pre-existing pathology.[1] The word atherosclerosis is derived from a Greek word meaning hardening. Atherosclerosis is a chronic inflammatory disease, causing more morbidity and mortality in the western world, affecting coronary, cerebral and peripheral vessels. Due to adoption of western lifestyle and reduction in the mortality from infectious diseases, there is an increased prevalence of ischemic heart disease in the developing nations.[2,3]

The most common cause of deaths worldwide is coronary artery disease (CAD). There is a higher prevalence of CAD in Indians as compared to Europeans, Americans and other Asians.[4,5] In Indian population atherosclerotic lesions occur 10 to 15 years earlier and the lesions are in the advanced stage.[6,7] It is difficult and expensive to evaluate the atherosclerotic lesions in the living subjects. Autopsy based studies are very crucial in studying the atherosclerotic lesions. Coronary artery disease is the reflection of deaths caused due to ischemic heart disease. Some studies from India noted the regional variation in CAD and reported a higher prevalence in southern India than other regions of the country.[7] The prevalence of coronary atherosclerosis is highly variable according to age, sex and geographic location.[6,8]

We wanted to study the presence of atherosclerosis in the coronary vessels in autopsy cases and correlate CAD with age and sex of the study cases.

METHODS

This study was carried out in the Department of Pathology at a Tertiary Health Care Centre and a teaching institute of Central India. The study period was of 14 months from 1st January 2019 to 29th February 2020. This was an observational prospective study. Medico-legal specimens are referred for the histopathological examination from the Forensic Department of the Institution and from hospitals within the radius of 150 kilometres. The specimens were received in 10% formalin. The dissected heart specimens with coronaries were studied irrespective of the age and sex. Cases with properly preserved whole heart were included in the study. Cases in which only part of heart was received, and autolysed and decomposed heart specimens were excluded from the study.

Demographic data and post-mortem findings were collected from the available post mortem papers. Detailed gross examination of the heart was done. Condition of the heart was noted for the tissue preservation. Weight and dimensions of the heart were recorded. The external surface and the cut surface of the whole heart were examined for any abnormalities.

The dissection of the heart and the coronary blood vessels was done by Virchow's method as per the guidelines given by Ludwig.[9] The right and left ventricular wall thickness was measured as per the guidelines given by Ludwig.[9] The coronary vessels were examined for the patency, blockage of lumen and the condition of the vessel wall. Coronaries were dissected. Sections were taken from coronary arteries, right and left ventricular walls and any abnormal areas. Routine tissue processing, paraffin embedding followed by haematoxylin and eosin staining was done. Histopathological examination was performed in all the cases. Gross and microscopic findings were noted and analysed in the light of available clinical data.

RESULTS

The present study was an observational prospective study, comprising of the total 407 cases. There were 311 (76.5%) males and 96 (23.5%) females, as shown in graph number 1. The youngest case was a one-day old male child and the eldest was 81 years old male patient. Demography of the study is as shown in the table number 1. The maximum cases 209 (51.35%) were in the age of group 31 to 50 years. There were 100 cases less than 30 years of age and 98 cases more than 50 years of age. There were total 209 (51.35%) cases showing atherosclerosis in the study; out of which 170 (81.33%) were males and 39 (18.66 %) were females. There was no case of atherosclerosis in the age group less than 20 years. Graph number 2 shows the age and sex wise distribution of the cases showing atherosclerosis.

Out of total 70 cases in the age group of 21-30, 16 cases showed atherosclerosis. All were males. Out of these 13 cases showed triple coronary vessels [right coronary artery (RCA), left circumflex artery (LCX) and left anterior descending artery (LAD)] involvement, two showed double vessel involvement and a single case showed single vessel involvement. Myocardial infarction was seen in three; two were old healed infarct and one was recent infarct. There were maximum number 115 (55.02%) cases of atherosclerosis in the age group of 31-50 years. Males were 96 (83.47%) and females were 19 (18.52%). Infarction was seen in 26 cases, 23 were males and three were females. The old healed infarct was seen in 18 cases and recent infarct in eight cases.

The incidence of atherosclerosis and myocardial infarction in the later age groups was as shown in the table number 1. Atherosclerotic involvement of various coronary vessels was as follows left anterior descending artery (LAD) 62.15%, right coronary artery (RCA) 59.94% and left circumflex (LCX) 58.71%. Graph number 3 shows the age wise distribution of cases showing atherosclerosis and infarction in the study.

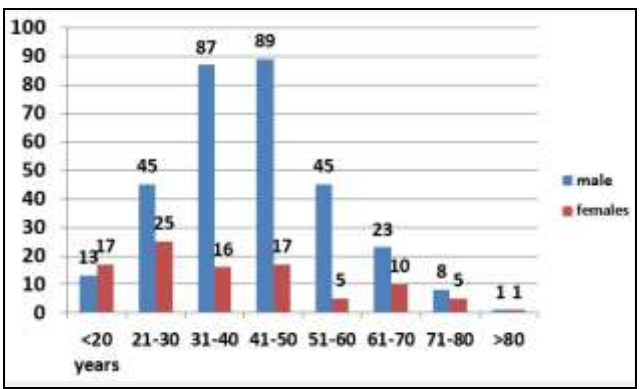
	Total Cases	Average Wt. of Heart in Gms	No. of Cases with Atherosclerosis	Single Vessel Involvement	Double Vessel Involvement	Triple Vessel Involvement	Total Infarct	Old Healed Infarct	Recent Infarct	Additional Finding
<10	09	63.33								
11 - 20	21	199.76								Myocarditis
21 - 30	70	245.78	16 (7.65 %)	01	02	13	03	02	01	Leukaemic Infiltrate
31 - 40	103	280.24	61 (29.18 %)	--	19	42	12	08	04	Pericarditis
41 - 50	106	287.50	54 (25.83 %)	07	10	37	14	10	04	Myocarditis Leukaemic Infiltrate
51 - 60	50	323.10	40 (19.17 %)	03	08	29	11	09	02	Pericarditis Cardiac Tamponade
61 - 70	33	315.45	24 (11.48 %)	02	06	16	07	04	03	
71 - 80	13	315.86	12 (5.74 %)	--	03	09	06	04	02	Osseous Metaplasia
> 81	02	345	02 (0.95 %)	--	--	02	01	01	00	
Total	407		209 (100 %)	13 (6.22 %)	48 (22.96 %)	148 (70.81 %)	54	38	16	

Table 1. Demography of the Study Participants

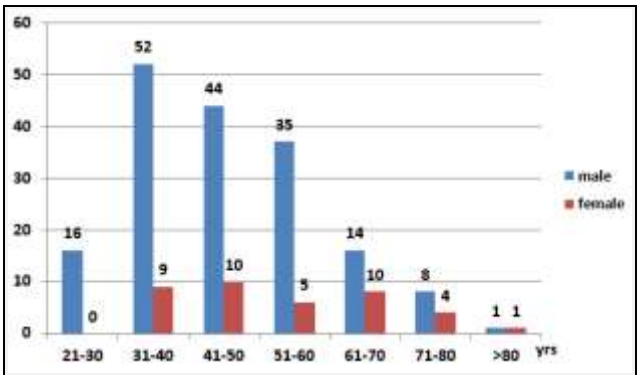
	RCA- Total Involvement (59.94%)				LCX- Total Involvement (58.71%)				LAD- Total Involvement (62.15%)			
Status of vessel	N	mild	mod	sev	N	mild	mod	Sev	N	Mild	Mod	Sev
Total	163	172	39	33	168	162	39	38	154	165	43	45
Percentage	40.04	42.26	9.58	8.10	41.27	39.80	9.58	9.33	37.83	40.54	10.56	11.05

Table 2. Degree of Coronary Vessels Obstruction

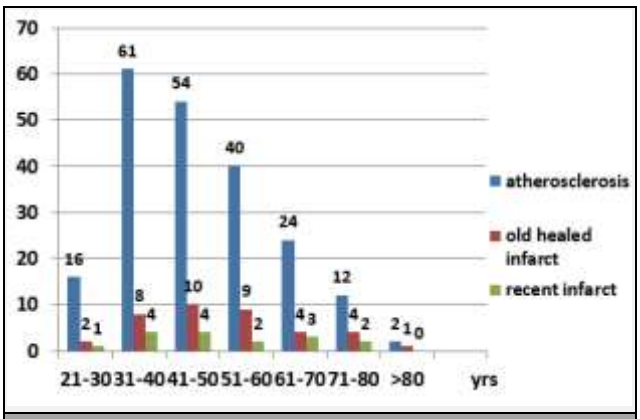
Abbreviations- N- normal, mod-moderate, sev- severe RCA- right coronary artery, LAD- left anterior descending coronary artery, LCX- left circumflex coronary artery



Graph 1. Age and Sex Wise Distribution of the Study Cases



Graph 2. Age and Sex Distribution of Cases of Atherosclerosis



Graph 3. Age Wise Distribution of Cases Showing Atherosclerosis and Infarction

Infarction was seen in 54 (13.26%) cases, starting in the early age of 21 years. Out of these 54 cases, 45 (83.33%) were males and nine (16.67%) were females. Total old healed infarct was seen in 38 cases and recent infarct in 16 cases. Out of these 54 cases, 12 cases showed infarction in both right and left ventricular wall. In all the 54 cases at least one coronary vessel showed atherosclerosis.

Single vessel, double vessel and triple vessel involvement of coronaries were as shown in table number 1. Grading of coronary obstruction was done as follows- Mild lumen obstruction (less than 50%), moderate (50-75%), severe (more than 75%). Number of cases showing, mild, moderate and severe obstruction of the coronaries due to atherosclerosis was as shown in table number 2. Calcification was seen in the 43(20.57%) cases, irrespective of the grade of atherosclerosis. The weight of heart in the various age groups was as shown in table number 1. The mean weight of the heart was 264.37 grams.

We had two cases of myocarditis; one was 20 years female and second was 45 years male. There were three cases of pericarditis, one 32 years female and two males of 38 and 54 years. There were two cases of leukemic infiltration in the myocardium. One 50 years male was a diagnosed case of chronic myeloid leukaemia and the other was a 27 years female, a diagnosed case of acute myeloid leukaemia. One case of cardiac tamponade was detected in a 56 years male. The heart weight was 600 grams. The heart showed evidence of old infarct and coronaries showed atherosclerosis with calcification. An interesting and rare finding of myocardial osseous metaplasia was seen in a 74 years male. The heart weight was 550 grams. There was 5 x 5 x 1 cm diffuse hard grey-white area in the right ventricular wall. Sections from that area showed myocardium with osteoid formation and calcification. Gross and microscopic features were of osseous metaplasia probably secondary to myocardial infarction. In the present study, no case of congenital heart disease was detected.

DISCUSSION

The incidence of coronary artery disease (CAD) has markedly increased in India over the past few years. Ischemic heart disease (IHD) is the largest cause of

morbidity and mortality in the developed and developing countries. Today, deaths due to IHD are overwhelmingly contributed by atherosclerosis. One fifth of deaths in India are due to CAD, as per the 2002 World Health Report. CAD will soon become a single largest disease, accounting for one third deaths in India.[4,5] Atherosclerosis is a chronic inflammatory disease. The healing response of the arterial wall to the endothelial injury plays an important role in its pathogenesis. Interaction of endothelial cells with modified lipoproteins, monocytes derived macrophages, T lymphocytes and smooth muscle cells of the arterial wall is responsible for the progression of the lesion.[2] Due to adoption of western lifestyles and reduction in the mortality from infectious diseases, there is increased prevalence of ischemic heart disease in the developing nations.[2] Coronary atherosclerosis begins in childhood or adolescence and its late manifestation is IHD.[10]

In the present study a total of 407 cases were studied. There were 311 (76.41%) males and 96 (23.57%) females. Male predominance was also seen in the other studies.[7,10,11,12] Progressive narrowing of the lumen of coronaries due to atherosclerosis is responsible for the clinical manifestation. Obstruction of more than 75% of the cross-sectional area of the vascular lumen elucidates significant coronary artery disease.[10] In the present study atherosclerosis was not seen in the cases less than 20 years of age. In the study of Monica Garg et al the changes of atherosclerosis were seen at an early age of 15 years.[10] The overall incidence of atherosclerosis in the present study was 51.35%, which was higher than other studies.[10,13] Cases of atherosclerosis were seen from third decade, with maximum number of cases in the fourth decade. In the age group of more than 80 years, there were two cases, and both showed atherosclerosis. Single vessel involvement was seen in 6.22%, while double vessel and triple vessel involvement were seen in 22.96% and 70.81% cases respectively. In the present study triple vessel involvement was the most common finding; the similar finding was noted by Monika Garg et al and Yazdi et al.[10,13] In the study by Virmani et al single vessel disease was more common than double and triple vessels.[14]

The left anterior descending artery (LAD) was the most common vessel involved followed by right coronary artery (RCA) and left circumflex coronary artery (LCX). This was in concordance with many studies. [3,10,13] Number of cases showing mild, moderate and severe atherosclerosis were as shown in the table number 2. As compared to other studies in which moderate and severe atherosclerosis was more common, in the present study the incidence of mild atherosclerosis was higher.[5,10,12] Calcification was seen in 43 (20.57%) cases, irrespective of the grade of atherosclerosis. Presence of calcification in the coronary vessels means there is marked obstruction, elsewhere in the same vessel and presence of obstruction in the other vessels. The site of maximum obstruction may not be at the site of calcification.[15]

In the present study the highest incidence of infarction was seen in the fifth decade. In other study, the highest incidence was in the sixth decade.[16] Old healed infarct was common than the recent infarction, similar observation was made by Sonawane SY et al.[17] In the present study there were two cases of myocarditis. Sonawane SY et al and Ahmad M et al also reported cases of myocarditis.[17,18] There were three cases of pericarditis and two cases of leukemic infiltrate in myocardium in our study. Interesting cases of cardiac tamponade and osseous metaplasia were also reported in our study. Osseous metaplasia in the myocardium is a rare finding.[19] In the present study, mean heart weight was 264.37grams. Mean heart weight in other studies was 286±72 grams and 327 grams.[10,20] The strong point of the study is the analysis of a large number of cases. These cases were studied for the presence of atherosclerosis and myocardial infarction. A significant number of cases showed atherosclerosis and infarction at an early age.

Limitations

There are a few limitations of the present study. The cause of death was not studied as the complete clinical details were lacking. All the three vessels- coronary, cerebral and peripheral vessels were not studied. The location of the atherosclerosis in the coronary artery tree was not specified.

CONCLUSIONS

Coronary atherosclerosis is a frequent cause of death worldwide. Atherosclerosis was seen in 51.35% cases. Atherosclerosis was seen even at 21 years. There was a male predominance. LAD was the most common coronary artery involved. There was a higher incidence of triple vessel disease. There is a need of early detection and identification of various risk factors to prevent the development of atherosclerosis and its consequences. Autopsy based studies are important. Study of coronaries, along with cerebral and peripheral vessels, its clinical correlation, and antemortem investigations used for detection of atherosclerosis can be undertaken in future.

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