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Original Research Article

A Retrospective Study on Microscopic Changes of Heart in Sudden Death of Young Individuals.

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Article Info

Abstract

When an individual succumbs to illness within 24 hours of onset of symptoms, from causes other than unnatural causes, then deaths would be grouped under sudden death. Coronary artery disease tops the list by being the most common factor responsible for sudden death. Coronary artery diseases are by no means restricted to old age now. Many young individuals are becoming victims of this illness unknown to them. This study aims at understanding the presentation of this illness at microscopic level to aid in reducing loss of precious human lives.

1. Introduction

Coronary artery diseases are the most common disease entity to cause sudden death in developing countries. Incidence of Myocardial infarction is 5/1000 deaths per year.[1] 50 percent of deaths due to myocardial infarction happens within 1-2 hours of onset of symptoms[2] which includes known illness prior to this event as well as first time patients. Over the past decade, incidence of acute myocardial infarction among the persons of age < 50 years is increasing. Increased cardio vascular risk factors such as diabetes mellitus, obesity, systemic hypertension, hyperlipidemia is contributing to this changing trend. This study concentrates on the microscopic changes in heart, grade of atherosclerosis found during autopsy. Age wise analysis in this study can be useful in screening the high risk individuals and further reduction in mortality & morbidity.

2. Materials and Methods:

Inclusion criteria:
1. Include both sex of age groups 25 – 50 years;
2. Presenting for the first time with signs and symptoms of coronary heart disease;
3. Treatment for the present illness started and patient could not be saved or brought dead case without previous cardiac illness history, received at Hospital Casualty of Thanjavur Medical College Hospital.
4. Occlusion in at least one of the coronary arteries.

Exclusion Criteria:
1. Brought dead cases due to unnatural events like road traffic accidents, railway cases, insect bite and poisoning cases etc.;
2. Death due other natural causes, with prior history or found at autopsy;
3. Obscure autopsy and Negative autopsy.

Study design: Retrospective Cross Sectional Study.

Size and place of study:

100 cases of medico legal autopsies with microscopic changes in coronary arteries are studied. Cases between January - 2016 to January - 2018 were taken up for study period.

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Department of Forensic Medicine and Toxicology, Thanjavur Medical College, Thanjavur, Tamilnadu – a Tertiary Care Hospital was the place of study.

Methodology:

Dead bodies were kept in individual compartment type cold storage between 0 to 4 ^{0}C, from the time of reception till the time of start of autopsy. Medico legal autopsy were conducted as per standard protocol and guidelines. During the conduct of autopsy, gross examination of heart was done, washed, and dissection was carried out by inflow-outflow method and short axis method and then weighed. Coronary vessels were incised at every 01 - 03 mm interval and examined. Sections from anterior & posterior surface of both ventricles, interventricular septum, atrium and coronary vessels were sent for histopathological examination of heart for hematoxylin and eosin staining. Specimens were preserved in 10% formalin between 03 to 06 days and there after stained and studied.

3. Results:

Age wise distribution of cases was maximum in 35-40 years followed by 40-45 years. Minimum no of case was seen in 20-25 years. Sex wise, 93% cases were male, 07% were female.

Weight:

Weight of the heart was more than 450 gm in 18 % of cases, weight was between 350 - 450 gm in 46% cases, weight was between 250 – 350 gm in 36 % of cases (**Table No. 1**).

Arterial involvement:

Atherosclerotic obstruction of Left Anterior Descending Artery was seen in 94% of cases, Left Circumflex Artery - 60% of cases and Right Circumflex Artery - 61% of cases. Coronary artery occlusion was seen in the following manner: Out of the 94 cases having occlusion in Left Anterior Descending Artery (12 cases had occlusion in Left Anterior Descending Artery alone, 23 cases had occlusion in Left Anterior Descending and also in Left Circumflex; 26 cases had occlusion in Left Anterior Descending and Right Circumflex Arteries, 33 cases had occlusion in all three Left Anterior Descending, Left Circumflex and Right Circumflex Arteries); Of the 68 cases having occlusion in Left Circumflex Artery (04 cases had occlusion in Left Circumflex Artery alone, 23 cases had occlusion in Left Anterior Descending and also in Left Circumflex; 08 cases had occlusion in Left Circumflex, 33 cases had occlusion

in all three Left Anterior Descending, Left Circumflex and Right Circumflex Arteries); Of the 69 cases having occlusion in Right Circumflex Artery (02 cases had occlusion in Right Circumflex Artery alone, 08 cases had occlusion in Right and Left Circumflex arteries, 26 cases had occlusion in Left Anterior Descending and Right Circumflex Arteries, 33 cases had occlusion in all three Left Anterior Descending, Left Circumflex and Right Circumflex Arteries).

Occlusion grades:

Single vessel occlusion is 18 % of cases; Double vessel involvement is 57 % of cases; Triple vessel involvement is 33 % of cases. With respect to occlusion, 09% cases were Grade II, 13% cases were Grade III and 78% cases were Grade IV blocks (**Table No. 2**).

Microscopic examination:

Most common finding was myocardial infarction with atherosclerosis. Of which, Acute Myocardial Infarction (**Fig. 1**) – 51% cases, healing stage of Myocardial Infarction (**Fig. 2**) - 21% cases, Healed Myocardial Infarction (**Fig. 3**) - 08% cases, Nonspecific heart findings – 18% cases (**Table No. 3**).

Table 1: Weight of heart:

Weight in grams	Frequency	Percentage
< 250 g	Nil	Nil
250 - 350 g	36	36 %
350 – 450 g	46	46 %
> 450 g	18	18 %

Table 2: Grading of Atherosclerosis:

Grading	Frequency
0 - 25	Nil
26 - 50	09
51 - 75	13
76 - 100	78

Table 3: Microscopic findings:

Grading	Frequency
Acute MI	51
Healing MI	21
Healed MI	08
No significant finding	10

4. Discussion:

Atherosclerosis narrowing of vessels are seen most commonly in proximal portion of Left Anterior Descending Artery, followed by Left Circumflex Artery and then in Right Coronary artery. Less often narrowing is seen in major secondary epicardial branch, diagonal branch of LAD, obtuse marginal

branches of LCA or posterior branch of LCA or posterior branch descending of RCA.[1]
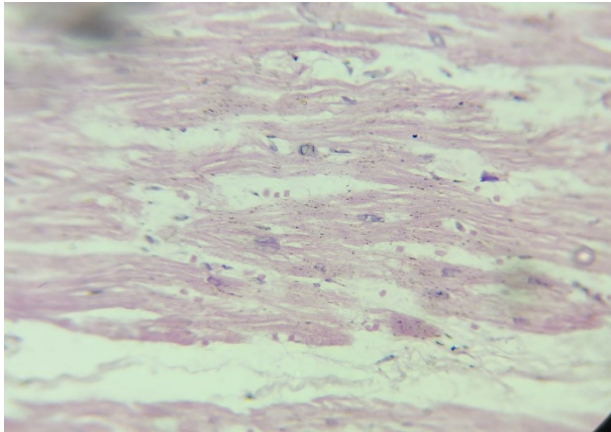
Fig. No.1: Acute Neutrophilic infiltration – Acute MI.
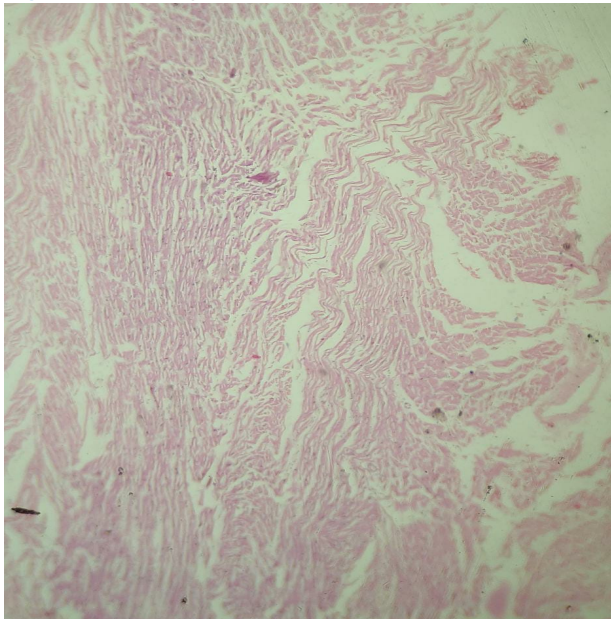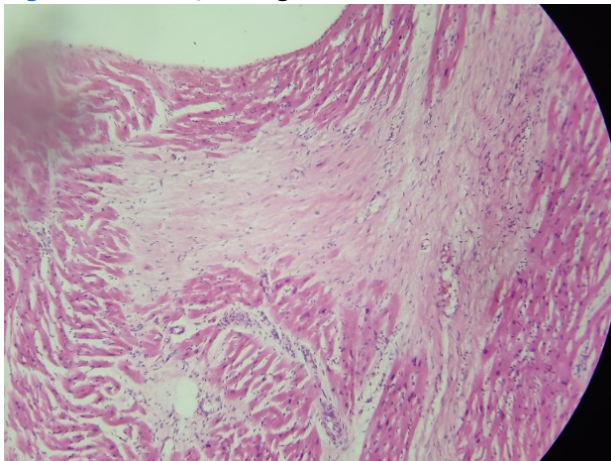

Fig. No. 2: Wavy fibers – Acute MI.

Fig. No. 3: Scar / Collagenous tissue – Old MI.

For statistical convenience, vessels are grouped under Left Anterior Descending, Left circumflex and Right Circumflex. Gross changes regarding redness, redness and pallor, yellow bordering, yellow green area and healed white scar were also noted.[2,3,4] Approximate lumen narrowing, atherosclerotic changes were noted and graded as follows: Grade 1: 0 - 25%; Grade 2: 25 - 50%; Grade 3: 50 - 75%; Grade 4: 75 - 100%. Incidence of sudden death due to coronary artery disease (MI) varies considerably in autopsy material, partly because of different methods of demonstrating the muscle necrosis.[5] Microscopic changes on heart among young individuals can be reliably used to prevent coronary artery diseases by taking appropriate screening. [6,7] Microscopic changes in myocardial infarction includes, within 06 hrs. – infarct muscle fibers were edematous, vascular degeneration and myocytolysis, by 12 hrs. – loss of striations, intense eosinophilic, hyaline appearance and nuclear changes, after 24 hrs. - shrunken eosinophilic cytoplasm and pyknosis of nuclei and less neutrophilic infiltration.[8] Within 48 - 72 hrs. the coagulative necrosis is completely seen neutrophilic infiltration; 1st week - macrophages appear with proliferation of capillaries and fibroblast; 3rd week fibro-vascular reaction is more prominent, newly formed collagen fibers, pigmented macrophages seen. End of 6th week - increased fibro-collagenous tissues, decreased vascularity, lymphocytes. Plasma cells disappears.[9]

Above findings can be grouped as follows: Microscopic finding of presence of coagulative necrosis with various degree of nuclear changes and prominent infiltration of neutrophils are grouped as Acute Myocardial Infarction; Heart showing above mentioned changes in various stages with presence of mononuclear leucocytes and fibroblasts without neutrophils were grouped as Healing Myocardial Infarction; Heart showing presence of collagenous scaring without cellular infiltration were labelled as Old healed Myocardial Infarction; Hearts with infiltration edema, patchy eosinophilic were considered as inconclusive for infarction and were given wider name 'death due to coronary artery disease'.[9]

In our study, Maximum number of cases were observed in the age group 35-40 years followed by

40-45 years. Similar finding was reported by Jochi C[9], Ramazan Karanfil[10] and Stavroula A[11], Bora Ozdemir[12] reports maximal incidence in 40-45 years. Sex wise distribution was seen predominantly in male sex. This is similar to Joshi C[9] reported 85.21% males and 14.8% females, Bora Ozdemir[12] reported 73% male 27% females Ramazan Karanfil[10] reported 74% male and 26% female. Vessel involvement in our study was LADA 94 cases, LCX 60 cases and RCA 61 cases, it is similar to study by Rao D[13], Porwal V[14], Garg M[15], Beelwal D[16].

All cases of coronary atherosclerosis are based the extent of occlusion of coronary vessel lumen by atherosclerotic plaques. In this study 09 cases were in 25 - 50% occlusion of vessels, 13 case were in 50 - 75% occlusion of vessels, 78 cases were in 75 - 100 % occlusion of vessels. Results were similar to histological grading of atherosclerosis as per American Heart Association guidelines where maximum no of cases were seen in Grade IV followed by Grade III. Acute myocardial infarction cases were 51%, healed was MI 21%, similar to Ramazan Karanfil[10] - 48%, but not similar to study reported by Joshi C for acute MI 45%, old MI 55%, Rao D[13] reported for acute MI 24%, and old MI 27%., Jochi C[9] - 28%, Bora Ozademir[12] - 26% for acute MI. Considering all the above study results, it is evident in all deaths, the deceased persons were almost normal / did not get medical attention before. Extent of the disease in autopsy specimens suggests a disease process rather than a simple event at a point of time. Financial, psychological factors, lifestyle pattern of the deceased are to be modified along with a common belief that myocardial infarctions are reserved to old age have to be forgotten. Screening and early intervention can find disease progression and prevent losses of these precious lives.

Limitations:

Study did not include cardiomyopathies, arrhythmic deaths, ventricular ruptures, aneurysmal ruptures etc. Study didn't include sudden deaths with non-specific / obscure findings in heart. Since early infarcts and small infarcts could have been missed on gross examination and person would have died before microscopic changes would set in. [17, 18]

5. Conclusion:

Coronary artery disease is the leading cause of natural deaths. Coronary atherosclerosis leads to myocardial infarction. To prevent coronary artery disease, individuals should follow healthy diet, stress reduction, regular physical activity, life style modification. Treating doctors shall start to screen for coronary events irrespective of the age group, whereby more epidemiological data, clinical probes for better individual risk prediction in high risk groups can be achieved to save precious lives.

Ethical Clearance: Yes.
Conflict of Interest: Nil.
External Funding: Nil.

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