

Original Research Article

Pathology of heart, coronaries and aorta in autopsy cases with history of sudden death: an original article

Sushil Y. Sonawane, Pushkar P. Matkari*, Gopal A. Pandit

Department of Pathology, Dr. V. M. Govt. Medical College, Solapur, Maharashtra, India

Received: 04 June 2017

Accepted: 03 July 2017

***Correspondence:**

Dr. Pushkar P. Matkari,

E-mail: drpushkarmatkari@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Natural deaths represent a large proportion of sudden (unexpected and unattended) deaths. The term “sudden cardiac death” (SCD) refers to death from the abrupt cessation of cardiac function due to cardiac arrest. The objective of this study was to identify various causes, risk factors, age and sex distribution associated with sudden cardiac death in an Indian setting.

Methods: Detail review of medical records and an autopsy study of all cases of sudden cardiac death that occurred instantaneously or within 24 hours of onset of symptoms in a tertiary care institution, between December 2010 and December 2015 was carried out.

Results: In total, 124 cases of sudden death were studied during this period. Out of 124 cases, 109 cases (87.90%) showed pathology in heart and aorta. Atherosclerotic coronary heart disease was the most common cause of death (72.58%) followed by Hypertensive heart disease (4.83%), Hypertrophic cardiomyopathy (3.22%), Myocarditis (3.22%), Infective endocarditis (1.61%), Rheumatic heart disease (0.8%), Aortic dissection (0.8%), and syphilitic aortitis (0.8%).

Conclusions: Sudden death is a source of concern and a detailed postmortem examination is mandatory to ascertain its cause. Presence of co-existing conditions like diabetes and hypertension contribute immensely to the risk of sudden death. Occurrence of sudden death at a younger age presents a formidable challenge. Prevention of development of risk factors of atherosclerosis at an early age can be an effective strategy to counter this ailment at all levels.

Keywords: Atherosclerosis, Heart, MI, Sudden death, Hypertension

INTRODUCTION

Natural deaths represent a large proportion of sudden (unexpected and unattended) deaths. The term “sudden cardiac death” (SCD) refers to death from the abrupt cessation of cardiac function due to cardiac arrest. Sudden unexpected deaths due to cardiovascular diseases occupy almost a half of those natural deaths and more than 80% of cardiovascular deaths are associated with coronary atherosclerosis.¹⁻⁴

There is no clear consensus on the definition of SCD.⁵ WHO defines sudden death as a death that occurs within 24 hours after the onset of symptoms.^{6,7}

Reduced mortality from infectious diseases and the adoption of Western lifestyles has led to increased prevalence of ischemic heart disease in developing nations.⁸

Hence the purpose of this study was to analyse sudden death and its various causes in detail to help fill the knowledge gap, advance the information about this topic and provide useful inputs for prevention, early diagnosis and treatment of these lethal conditions.

METHODS

This is a descriptive study carried out at a tertiary care institution in India. Data from December 2010 to July 2015 was collected. WHO definition (death that occurs within 24 hours after the onset of symptoms) of sudden death was used as criteria for selection of cases. All the adult cases (above 18 years. of age), with or without past history of heart disease, fulfilling the criteria of sudden death were included in the study. The cases in which death occurred due to unnatural causes like accident, homicide, suicide was excluded from the study.

The clinical records were scanned for age, sex, mode of presentation, past history, the presence of risk factors and investigations if any. The details of autopsy findings, were obtained from the autopsy records. Hearts were studied in detail both grossly and microscopically.

RESULTS

In total, 124 cases were studied during this period. Out of 124 cases, 109 cases (87.90%) showed pathology in heart and aorta (Table 1). No specific cardiovascular lesion was seen in 15 cases (12.09%).

Table 1: Various pathological lesions found in heart and aorta and their incidence.

Pathological lesions	No. of cases (out of 124)	Percent
Atherosclerotic coronary artery disease	90	72.58%
Hypertensive heart disease	06	4.83%
Myocarditis	04	3.22%
Hypertrophic cardiomyopathy	04	3.22%
Infective endocarditis	02	1.61%
Rheumatic heart disease	01	0.80%
Aortic dissection	01	0.80%
Syphilitic aortitis	01	0.80%
No specific cardiovascular lesion	15	12.09%

Their clinical presentations were breathlessness in 39 cases (31.45%), chest pain in 30 cases (24.19%), sudden collapse/unconsciousness was observed in 29 cases (23.38%) and 26 cases (20.96%) were brought dead. In the present study, 14 cases had history of hypertension (HT), 12 cases had history of diabetes mellitus (DM) and 10 cases had previous history of heart disease. HT and DM coexisted in 5 cases out of which 4 cases had past history of heart disease.

The age ranged from 18 years - 84 years (Table 2). 41-50 years was the most common age group affected. Males (101 cases - 81.45%) were significantly more affected than the females (23 cases - 18.54%). Total male to female ratio was 4.39:1.

Table 2: The age and sex distribution of cases.

Age groups (in years)	Number of cases (%)	Males	Females
18-20	2 (1.61%)	1	1
21-30	16 (12.90%)	11	5
31-40	27 (21.77%)	23	4
41-50	29 (23.38%)	26	3
51-60	25 (20.16%)	22	3
61-70	18 (14.51%)	12	6
71-80	6 (4.38%)	6	0
81-90	1 (0.08%)	0	1

Atherosclerotic coronary artery disease (CAD) (90 cases - 72.58%) was the most common lesion followed by hypertensive heart disease (6 cases - 4.83%). Triple vessel disease was the most common morphological lesion observed in 50 cases (55.55%) of atherosclerotic CAD (Figure 1 and 2). Coronary thrombosis was observed in 38 (42.22%) out of 90 cases of atherosclerosis.

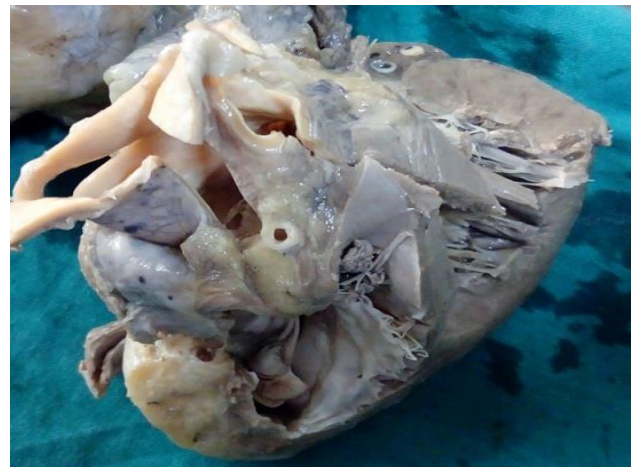


Figure 1: Coronary artery thickened due to atherosclerosis resulting in narrowing of lumen.

Myocardial infarction (MI) was observed in 58 out of 90 cases of atherosclerotic coronary artery disease. Old healed MI (Figure 3 and Figure 4) was the predominant type of MI observed in 28 cases (48.27%), followed by recent MI constituting 19 cases (32.75%). Changes of both recent and old MI were seen in 11 cases (18.96%). In majority of cases (84.49%), infarction was found to be of transmural type.

In present study, changes of hypertensive heart disease were observed in 6 out of 124 cases (4.83%). Age range was found to be from 48 - 70 years, 4 out of 6 cases were

males and 2 were females. All 6 cases had history of long standing hypertension, since more than 15 years. Grossly weight of the heart in all cases exceeded 450 gm and left ventricular thickness varied from 1.8 - 2.5 cm. All cases showed varying degrees of atherosclerosis in coronaries and aorta. Changes of hypertension were also evident in other organs like benign nephrosclerosis in kidney, concentric hypertrophy of blood vessel walls etc. Microscopically, there was variation in cell size with cellular and nuclear enlargement and interstitial fibrosis.

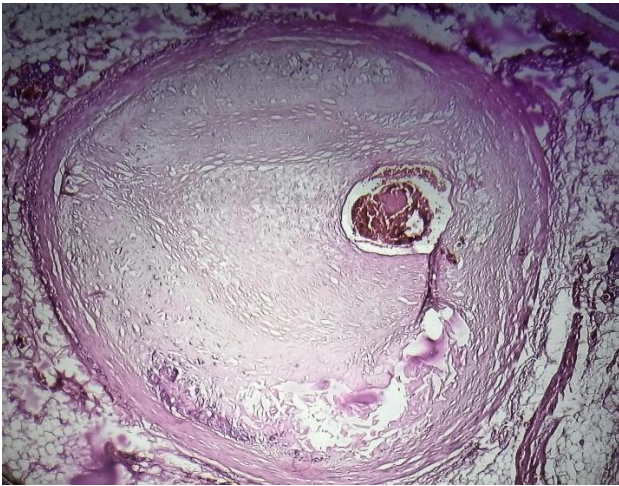


Figure 2: Photomicrograph showing near total occlusion of right coronary artery by fibroatheromatous plaque. (H and E stain, magnification - 400x).



Figure 3: Large whitish patch (arrow) over lower part of interventricular septum extending upto the apex of heart in a case of old healed myocardial infarction.

Both hypertrophic cardiomyopathy and acute myocarditis accounted for 4 cases each. Both the conditions were

found to be common in young males. In HOCM, the heart was massively enlarged in all cases, heart weight exceeded 600 gms. There was concentric and symmetric hypertrophy in 2 cases and in other two cases interventricular septum was disproportionately thickened compared to the left ventricular wall. One of the cases showed banana shaped left ventricular cavity.

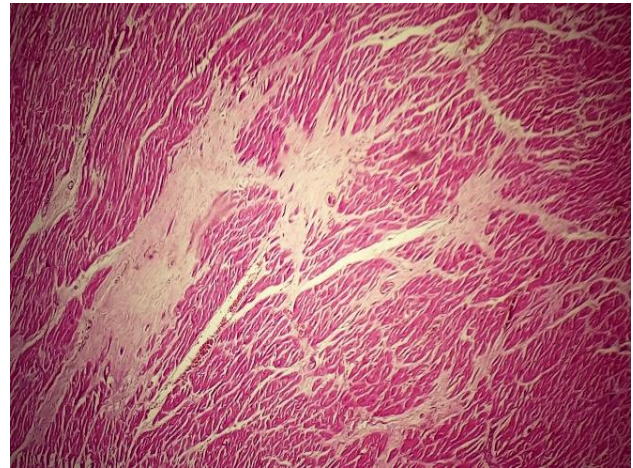


Figure 4: Photomicrograph showing healed infarct. Myocardium has been replaced by dense fibrous scars. (H and E stain, magnification - 40x).

Infective endocarditis was observed in 2 cases. In one of the cases, changes of fibrinous pericarditis were observed i.e. pericardium was thickened and showed numerous fibrinous tags having a shaggy appearance.

There was a single case of rheumatic heart disease in the present study. Mitral valve showed large irregular vegetations measuring 1.2 - 2.5 cm in diameter on the cusps of the valve and extending onto the adjacent chordae tendineae.

Aortic lesions

Aortic atherosclerosis - Aortic atherosclerosis was noted in 80 cases (64.51%) out of total 124 cases. Majority of the cases involved abdominal aorta. There was one case each of syphilitic aortitis and aortic dissection. In case of SA, grossly there was a lesion 1 cm above the root of aorta with ragged surface measuring 5 cm in length. Intima showed characteristic tree bark appearance. Adventitia showed proliferative endarteritis and infiltration by plasma cells. Aortic Dissection was observed in an old man 84 years of age, who complained of back pain and pain in the chest few hours prior. On admission, he was found to be unconscious. There was past history of hypertension. Heart was normal in size, weighing 300 grams. Arch of aorta and ascending aorta showed fatty streaks and formation of a false channel. An irregular, vertical, full thickness intimal tear was seen measuring about 8 cm in length filled with blood clots and fibrin. Dissection in ascending aorta extended upto the sinotubular junction.

DISCUSSION

In the present study, age ranged from 18-84 years, 41-50 years (23.38% cases) was the most common age group involved while Kasthuri et al, reported most cases in 31-40 years and a study conducted in Brazil by Braggion-Santos et al.^{9,10} had 60-69 years as the most common age

group. These variations in age incidence may be due to geographical factors and sample size variation.

Males were more commonly affected as compared to females in the present study and the studies conducted noted by Wang et al and Braggion-Santos et al and Kasthuri et al.⁹⁻¹¹

Table 3: Comparison of various pathological lesions found in heart and aorta and their incidence.

Pathological lesions	Present study	Farioli et al ¹²	Wang et al ¹¹	Santos et al ¹⁰	Ahmad et al ¹³	Kasthuri et al ⁹
Atherosclerotic coronary artery disease	72.5%	78%	50.3%	64.1%	79%	76.92%
Hypertensive heart disease	4.83%	7%	-	-	-	-
Myocarditis	3.22%	1%	14.8%	0.1%	3%	-
Hypertrophic cardiomyopathy	3.22%	4%	4.5%	32.1%	8%	7.69%
Infective endocarditis	1.61%	-	-	-	-	-
Rheumatic heart disease	0.80%	-	-	-	-	-
Aortic dissection	0.80%	-	-	-	-	-
Syphilitic aortitis	0.80%	-	-	-	-	-
No specific cardiovascular lesion	12.09%	-	12%	4%	4%	-

In the present study, atherosclerotic coronary heart disease was the principal cause of death (72.58%) followed by hypertensive heart disease (4.83%), hypertrophic cardiomyopathy (3.22%), myocarditis (3.22%), infective endocarditis (1.61%), aortic dissection (0.8%), and syphilitic aortitis (0.8%). Atherosclerotic coronary artery disease was the leading cause of death in all the studies however Wang et al, reported the lowest percentage (50.3%) while Farioli et al, reported the highest percentage (78%) of deaths due to atherosclerotic CAD.^{11,12} Coronary thrombosis was found in 38 cases (42.22%) in the present study as compared to Ahmad et al, who found thrombosis in 71.11% cases (37 of 52) and Burke et al, reported thrombosis 52.21% cases (59 of 113).^{13,14}

In the present study, Myocardial infarction was observed in 64.44% cases (58 out of 90 cases) of atherosclerotic CAD. Old healed MI was the predominant type of MI seen in 28 out of 124 cases (22.58%) followed by recent MI in 19 out of 124 cases (15.32%). Both recent and old MI were seen in 11 cases (8.87%). Ahmad et al, classified MI into 2 categories - recent and old MI, reported old MI in 35.1% cases and recent MI in 20% cases respectively.¹³ In the present study, there were 6 cases (4.83%) of hypertensive heart disease with left ventricular hypertrophy. In a study conducted by Farioli et al left ventricular hypertrophy coupled with hypertensive heart disease was the underlying cause of death in 7 cases (7%).¹²

Both myocarditis and hypertrophic cardiomyopathy as causes of death showed high degree of variation in

different studies. In case of myocarditis our findings (3.22%) were closest to Ahmad et al, (3%) while in case of hypertrophic cardiomyopathy Farioli et al, (4%) showed similar findings to that of ours.^{12,13}

Most cases of hypertrophic cardiomyopathy were observed in young men in the present study similar to that observed in other studies. Margey et al, conducted a study in Ireland on causes of sudden death in patients in the age range of 14-35 years.¹⁵ HCM accounted for 14.7% cases in their study. In the present study, there were 30 patients in similar age group of 18-35 years and we found HCM in 3 out of those 30 cases i.e. (10%).

There was no specific cardiovascular pathology in 15 out of 124 (12.09%) cases in the present study. Cause of death remained undetermined. But the heart that is normal even after complete post-mortem examination may still harbour the cause of sudden death, the current standard of general autopsy practice is not sufficient to detect certain abnormalities. Ventricular arrhythmia is the mechanism, occurring either spontaneously or in the setting of long QT interval, Brugada syndrome, preexcitation, or other electrophysiologic syndromes that can be documented during life. Many of these arrhythmias are inherited, and diagnosis is of paramount importance to the family.¹⁶

CONCLUSION

Sudden death is a source of concern and a detailed postmortem examination is mandatory to ascertain its cause. Atherosclerotic coronary artery disease is a major

cause responsible for maximum number of sudden deaths in India. Presence of co-existing conditions like diabetes and hypertension contribute immensely to the risk of death. Occurrence of sudden death at a younger age presents a formidable challenge. Because many victims are not known to suffer from heart disease and/or are considered to have a low risk of sudden death, more efforts are needed to prevent the development of risk factors, early identification of those at risk and to improve the out-of-hospital management. More studies are needed to create a wealth of information on this topic and develop India-specific strategies to counter this threat at all levels.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Yang KM, Lee SY, Kim YS, Lee JS, Seo JW. Guidelines for forensic assessment of natural unexpected cardiovascular death. *Basic Appl Pathol.* 2008;1:155-63.
2. Turakhia M, Tseng ZH. Sudden cardiac death: epidemiology, mechanisms, and therapy. *Curr Probl Cardiol.* 2007;32:501-46.
3. Lee WT, Cho WY, Ki CD, Kim JK, Kang SM. The statistical analysis on legal autopsy in 2006. *Korean J Leg Med.* 2007;31:139-46.
4. Mehra R. Global public health problem of sudden cardiac death. *J Electrocardiol.* 2007;40:S118-122.
5. Bulzan O, Pribac G. Case study on sudden cardiac death: Studia Universitatis "Vasile Goldiș", Seria Științele Vietii. 2010;20:17-20.
6. Furberg C, Romo M, Linko E, Siltanen P, Tibblin G, Wilhelmsen L. Sudden coronary death in Scandinavia. A report from Scandinavian coronary heart disease registers. *Acta Med Scand.* 1977;201:553-7.
7. Turan AA, Guven T, Karayel F, Pakis I, Gurpinar K, Ozaslan A. Subvalvular aortic stenosis as a cause of sudden death: two case reports. *Am J Forensic Med Pathol.* 2006;27(1):90-2.
8. Mitchell RN. Blood Vessels. In: Kumar V, Abbas AK, Aster JC. eds. *Robbins and Cotran Pathologic Basis of Disease.* 9th ed. Saunders Elsevier; 2015:483-522.
9. Kasthuri AS, Handa A, Niyogi M, Choudhury JC. Sudden death: a clinicopathological study. *J Assoc Physicians India.* 2002;50:551-3.
10. Braggion-Santos MF, Volpe GJ, Pazin-Filho A, Maciel BC, Marin-Neto JA, Schmidt A. Sudden cardiac death in Brazil: a community-based autopsy series (2006-2010). *Arq Bras Cardiol.* 2014;120-7.
11. Wang H, Yao Q, Zhu S, Zhang G, Wang Z, Li Z, et al. The autopsy study of 553 cases of sudden cardiac death in Chinese adults. *Heart Vessels.* 2014;29(4):486-95.
12. Farioli A, Christophi CA, Quarta CC, Kales SN. Incidence of Sudden cardiac death in a young active population. *J Am Heart Assoc.* 2015;4(6):e001818.
13. Ahmad M, Afzal S, Malik I, Mushtaq S, Mubarak A. An autopsy study of sudden cardiac death. *JPMA.* 2005;55:149.
14. Burke AP, Virmani R, Farb A. Coronary risk factors and plaque morphology in men with coronary disease who died suddenly. *New Eng J Med.* 1997;336(18):1276-82.
15. Margey R, Roy A, Tobin S, Okeane CJ, McGorrian C, Morris V, et al. Sudden cardiac death in 14 to 35 year olds in Ireland from 2005 to 2007: A retrospective registry. *Europace.* 2011;13(10):1411-8.
16. Finkbeiner, Ursell, Davis. *Autopsy pathology: A Manual and Atlas,* 2nd edition, Churchill Livingstone; 2004:131-136.

Cite this article as: Sonawane SY, Matkari PP, Pandit GA. Pathology of heart, coronaries and aorta in autopsy cases with history of sudden death: an original article. *Int J Res Med Sci* 2017;5:3287-91.