International Journal of Community Medicine and Public Health
Shah PA et al. Int J Community Med Public Health. 2017 Mar;4(3):792-796
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20170760

Original Research Article

Pattern of mortality in sudden death: an autopsy study

Pinkal A. Shah[1]*, Bhavna Gamit[1], Chintan Dalal[2], Pinal Shah[1]

[1]Department of Pathology, Government Medical College, Surat, Gujarat, India
[2]Department of Ophatholmology, Government Medical College, Surat, Gujarat, India

Received: 10 January 2017
Accepted: 08 February 2017

***Correspondence:**
Dr. Pinkal A. Shah,
E-mail: drpinkalshah@yahoo.com

ABSTRACT

Background: Sudden death has plagued mankind from time Immemorial. Clinical presentations include wide spectrum from symptom complex to completely asymptomatic. Sudden cardiac death in many cases, 'first and only symptom. The high incidence, sudden, unexpected nature, combining with the low successful rate of resuscitation, make sudden cardiac deaths a major unsolved problem. Therefore, this study was conducted to illustrate etiolopathology, risk factors and triggers of sudden death with the expectation to provide new insight in epidemiological aspects of sudden death, which will help in care of patients, and prevention of premature cardiac deaths.
Methods: A study of 50 cases of sudden death was conducted at tertiary care hospital. After evaluating detailed history from the family members, autopsy has been performed to find out cause of sudden death.
Results: Principal culprit of sudden death is cardiovascular disease. Highest numbers of sudden death are in middle age group and having male preponderance might be due to presence of multiple risk factors, which have added or multiplicative effect. There are few autopsy negative cases, which are unexplained sudden death.
Conclusions: Sudden and unexpected deaths in young population frequently become the subject of pathologic investigation to determine the cause of death.

Keywords: Autopsy, Cardiovascular disease, Sudden cardiac death, Sudden death

INTRODUCTION

Sudden death(SD) has plagued mankind from time Immemorial. Sudden death is the most serious social, economic and medical problem. Obviously, sudden death of the member of working generation is an extremely great loss for their families and the communities surrounding them.

One of the earliest descriptions of a sudden death event was reported in Froissart's Chronicles in the 14th century, with the first autopsy report of sudden cardiac death ascribed to Leonardo de Vinci in the 15th century.[1]

Incidence of coronary artery disease has doubled in Indians during the past three to four decades. It will soon emerge as the single largest disease accounting for nearly one third of all deaths in India. The number of deaths due to coronary artery disease in India is projected to increase from 1.591 Million in 2000 to 2.034 Million by year 2010 (WHO report 1999).[2] Clinical presentations of sudden death includes wide spectrum from symptom complex to completely asymptomatic.

Sudden death was defined by W.H.O. criteria as nontraumatic, natural, sudden death occurring within 24 hours, but of witnessed deaths, nearly 80% occurred within 2 hours.[3] Sudden deaths due to cardiac causes are

known as sudden cardiac death. Sudden cardiac death is Unexpected death due to cardiac causes, occurring in a short time period (generally within 1 hour of symptom onset) in a person with known or unknown cardiac disease.

Among all deaths, sudden death has accounted for 15-20%.[4]

Sudden death has accounted for 50 to 80% of all coronary deaths.[4]

Sudden cardiac deaths are accounted for >60% of all sudden deaths.[8]

Unexpected sudden death in all age groups, the cardiovascular system is the principal culprit and sudden cardiac death is a clinical syndrome that accounts for over half of all the mortality related to ischemic heart diseases. Death occurs within minutes or hours of onset of an arrhythmia, usually ventricular fibrillation and in most instances, no evidence of any recent coronary thrombosis or acute myocardial infarction can be identified as the trigger event and so there is no obvious morphologic change to explain the fatal arrhythmia.[7]

In many adults, sudden cardiac death is a first clinical manifestation of Ischemic heart disease.[5,6] Most cases of sudden cardiac deaths are related to cardiac arrhythmias. Beyond arrhythmic complications, patients with acute myocardial infarction may die from mechanical complications. Other causes of sudden deaths are cerebrovascular disease that includes cerebral haemorrhage and subarachnoid haemorrhage, brain infarct, gastrointestinal disease, respiratory disease, hepatic disease and blood disorders etc.

About 1 in every 20 cases of sudden cardiac death, no definite cause of death can be found, even after the heart has been examined by an expert cardiac pathologist. This is called sudden arrhythmic death syndrome. The most common electrophysiologic mechanisms leading to sudden cardiac death are tachyarrhythmias such as Ventricular fibrillation or Ventricular Tachycardia.[9,10]

METHODS

This study was conducted at tertiary care hospital over a period of 2 years. During this period 50 cases of sudden death were studied.

After evaluating detailed history of case from the family member, autopsy has been performed to find out cause of sudden death. In each case, after detail evaluation, post mortem examination has been performed and all fresh viscera have been received to pathology department. After gross examination of fresh viscera, proper cutting and fixation has been performed with 10% Formalin. After 2 days of fixation detailed examination and proper sectioning from representative sites has been done. Tissue processing was done in fully automated tissue processor. After block preparation, thin section cutting was performed by microtome. H and E stain was performed for microscopic examination.

RESULTS

Present study of 50 cases autopsies conducted at Pathology department, tertiary care hospital. The aim of this study is to classify underlying causes of sudden death, to find out risk factors, associated diseases and triggers of sudden death.

Table 1: Causes of sudden death.

Causes	No. of cases	%
Cardiac causes	34	68
Pulmonary edema	5	10
Sickle cell crisis	2	4
Respiratoey disease	2	4
Meningitis	2	4
Hemorrhagic brain infarct	2	4
Autopsy negative sudden death	3	6

Table 2: Frequency of sudden death in different age groups with comparison of cardiac and other causes.

Causes of sudden death	11-30 yrs		31-50 yrs		51-70 yrs	
	No. of cases	%	No. of cases	%	No. of cases	%
Cardiac causes	6	40	19	76	9	90
Other	7	47	5	20	1	10
Autopsy negative cases	2	13	1	4	0	0
Total	15	100	25	100	10	100

Major underlying cause of sudden death is cardiovascular disease in all age groups. Age is a dominant influence. Death rates from ischemic heart disease rise with each decade even into advanced age.

Among cardiac causes of sudden death, most common finding is ischemic heart disease. Out of 68% of sudden cardiac deaths, 44% cases show finding of ischemic heart disease. Next common cause is finding of atherosclerosis

(12%) without any other associated finding. Other findings include aortic stenosis (4%), cardiogenic pulmonary edema (4%), myocarditis (2%) and Left Ventricular Hypertrophy with atherosclerosis (2%) (Table 1).

Table 3: Association of diabetes mellitus with sudden death.

Age group	SD due to Cardiac causes	Other causes
11 to 30	0	0
31 to 50	13	2
51 to 70	7	0

This study suggest highest number of sudden death in age group of 31 to 50 yrs. Highest number of sudden deaths is in the middle age group, but highest number of sudden cardiac deaths is in the elder patients (Table 2).

Table 4: Association of hypertension with sudden death.

Age group	SD due to cardiac causes	Other causes
11 to 30	0	0
31 to 50	14	3
51 to 70	8	0

The present study shows changes of atherosclerosis in 54% of cases, highest in middle age group. Atherosclerosis is most potential risk factor for ischemic heart disease. In the present study, 21 of ischemic heart diseases are associated with atherosclerosis. Only single case of ischemic heart disease does not show atherosclerosis. Sometimes sudden cardiac death is a first indication of atherosclerosis.

Table 5: Association of hyperlipidemia with sudden death.

Age group	SD due to cardiac causes	Other causes
11 to 30	0	0
31 to 50	10	0
51 to 70	4	0

In the present study, total 6 cases show only atherosclerosis without any other findings.

Table 6: Association of smoking with sudden death.

Age group	SD due to cardiac causes	Other causes
11 to 30	1	0
31 to 50	16	1
51 to 70	8	1

Diabetes mellitus, hypertension, hyperlipidemia, smoking are important risk factors for atherosclerosis and ischemic heart disease. Out of 34 cardiac deaths, 20 had history of DM, 22 had history of hypertension, 14 had history of hyperlipidemia and 25 had history of smoking. While in non-cardiac sudden deaths, out of 16 deaths, only 2 had history of DM, 3 had history of hypertension and 2 had history of smoking.

Table 7. Comparison of causes of sudden death in different studies.

Underlying causes of sudden death	Mowada et al.[8]	Yaacov drory et al.[12]	Robert et al.[13]	Present study
Cardiovascular diseases	62%	73%	51%	68%
Cerebrovascular diseases	5%	12% (unidentifiable)	4%	4%
Others	33%	15%	45%	28%

Data shows highest prevalence of these risk factors in middle age group (Table 3,4,5,6).

DISCUSSION

Sudden death of young adult and working person is a great loss for their family and surrounding community. Our aim is to find out underlying causes of sudden death, triggers and risk factors (modifiable and non-modifiable) and associated diseases with sudden death. It's used to decrease the incidence of sudden death by preventive measures and to decrease the risk of sudden death in family members of victim.

The present study shows maximum numbers of Sudden deaths due to cardiac causes are in the age group of 51 to 70 years (90%). Maximum numbers of Sudden deaths due to cardiac causes are in the age group of 40 to 64 years.[11] The present study shows maximum numbers of sudden deaths in the age group of 31 to 50 years. The reason for such a disturbing trend may be multiple, like stressful life, altered food habits (junk food), smoking habit and other risk factors like, hypertension, diabetes mellitus, hyperlipidemia etc.

The present study shows only 3 cases of female candidates are subjected to autopsy examination. According to Makiko Owda et al, For all cases of sudden

death the ratio of M:F was 5.5.[8] The reason may be Higher prevalence of risk factors comparative to female or this study includes autopsy based cases; result may be biased due to this reason.

Underlying causes of sudden death

Major underlying cause of sudden death is cardiovascular diseases.

In the present study, 68%, major underlying cause of sudden death is cardiovascular diseases these findings are comparable to Owada M et al and Drory Y et al where cardiac causes in sudden deaths are 62% and 73% respectively (Table 7).[8,12]

The present study shows that 82.3%% of sudden cardiac deaths were due to coronary heart disease. 21 (42%) cases of ischemic heart disease are associated with atherosclerosis and 6 cases (12%) show only atherosclerosis without any other findings. The Zheng ZJ et al had 62% of sudden cardiac deaths were due to coronary heart disease.[17]

Atherosclerosis is a major risk factor for ischemic heart disease and sudden cardiac death.

More than 90% of cases, the cause of myocardial ischemia is reduction in coronary blood flow due to atherosclerotic coronary arterial obstruction. Myocardial ischemia is a major cause of sudden cardiac death in patient with coronary artery disease. It may be the sole cause in the absence of previous myocardial infarction or may trigger ventricular fibrillation in its presence.[16]

The present study shows 44% cases of ischemic heart disease without prior significant clinical history of cardiovascular disease, out of which 40% of cases have foci of healed myocardial infarction. Lecomte and associates reported on the autopsies in cases of sudden death occurring immediately after experiencing emotional stress.[14] 90% of the patients had no known antecedent clinical history of cardiovascular disease. In spite of this, evidence of previous myocardial infarction was present in 92% of the patients with corresponding coronary atherosclerosis.

Myocardial ischemia is an important trigger for the development of ventricular tachyarrythmias.[18] Patients with prior myocardial scarring, transmural or subendocardial, are at risk of ventricular arrhythmias and sudden death.[6]

In the present study, 4% cases show aortic stenosis with left ventricular hypertrophy, around 14% cases of sudden death show changes of pulmonary edema, out of these, 4% cases show Left ventricular hypertrophy. Left ventricular hypertrophy is increasingly recognized as an independent risk factor and is associated with increased incidence of sudden cardiac death.[15]

In the present study, 4% of sudden deaths are due to sickle cell crisis. According to Robert et al among non-traumatic sudden death, sickle cell trait was significantly associated with idiopathic sudden death compared with other causes of sudden death.[13] The exact pathogenesis leading to the death of the patient is in fact multifactorial.

Highest number of atherosclerosis is seen in middle age group. In present study, 48% of cardiac deaths are due to Coronary artery disease which is comparable to study conducted by Drory Y et al where largest number of deaths in >30 years was contributed to coronary artery disease 58%.[12]

Diabetes mellitus, hypertension, hyperlipidemia and Smoking are other important risk factors for atherosclerosis, ischemic heart disease and sudden death.

In the present study, association of diabetes mellitus, hypertension and hyperlipidaemia is very high with sudden cardiac deaths, 58%, 65% and 42% respectively and 73% of cases had history of smoking. Majority of cases are in the middle age group (Table 3,4,5,6). A smoking habit provided a significantly high correlation for sudden death of all causes and coronary artery disease, so smoking provokes sudden death and abnormal cholesterol concentrations led to rupture of vulnerable plaque.[2]Associated diseases like diabetes mellitus, hypertension and hyperlipidemia are known as potentially controllable risk factors**.**

In the present study, 6% cases do not show any significant pathological changes (Table 1). This might be "autopsy negative sudden unexplained death", the cause of which is most likely a primary arrhythmogenic event. This is comparable to the study conducted by Drory Y et al where 12% cases cause of death were unidentifiable. In some patients, the underlying defect responsible for a sudden cardiac death, is not found on gross, microscopic, or even ultrastructural examination of the heart. Autopsy studies of sudden cardiac death subjects have shown that structural cardiac abnormalities are absent in 5 to 8% of cases (Priori et al). With recent advances in molecular biology, it has become apparent that a proportion of these deaths are due to mutations in cardiac ion channels that may lead to ventricular arrhythmias and sudden death

CONCLUSION

Sudden death remains an important clinical and public health problem and become the subject of pathologic investigation to determine the cause of death.

Major non-modifiable risk factors for sudden cardiac deaths are increasing age and sex. Other potentially controllable risk factors are atherosclerosis, diabetes mellitus, hypertension, hyperlipidemia and cigarette smoking. Presence of two or more risk factors have added/ multiplicative effect.

Increased rates of sudden death among younger population warrant additional investigation of their potential risk factors. Public health education and media efforts should target young population to increase awareness of symptoms and signs of cardiac arrest, modifiable risk factors, improvement in life style.

Molecular genetic analysis in autopsy negative case is indicated for identifying the likely cause of sudden cardiac death and this should be extended to the surviving relatives of sudden cardiac death victim for risk stratification, reproductive counselling and for taking preventive measures in the surviving family members.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Brooks S. Edwards, Jesse E. Edwards, Pathology of Sudden Cardiac Death - An Illustrated Guide.2006.
2. Sudha ML, Sundaram S, Parushothaman KR. Coronary atherosclerosis in sudden cardiac death: an autopsy study. Indian J Pathol Microbiol. 2009;52(4).
3. Ladich E, Virmani R, Burke A. Sudden cardiac death not related to coronary atherosclerosis, Toxicol Pathol. 2006;34;52.
4. Kawamura T, Kondo H, Hirai M, Wakai K, Tamakoshi A, Terazawa T, et al, Sudden death in the working population, A collaborative study in Central Japan, Eu Heart J. 1999;20:338-43.
5. Sung RJ, Kuo CT, Wu SN, Lai WT, Luqman N, Chan NY. Sudden cardiac death Syndrome: age, gender, ethinicity and genetics. Acta Cardiol Sin 2008;24; 65-74.
6. Kumar V, Abbas AK, Fausto N. Pathologic basis of disease. In: Robbins and Cotran. The Heart. 7th Edi. 2004;586-7.
7. Madhubala Devi M, Devi SS, Debnath K, Th. Devi M, Singh HN. An autopsy case of sudden death in a patient with sickle cell disease. Indian J Hematol Blood Transfus. 2007;23(3-4):109-111.
8. Makiko Owada, Yohiharu Aizawa, Katsuyoshi, Kurihara. Risk factors and triggers of sudden death in the working generation: An autopsy proven case-control study. Tohoku J Exp Med. 1999;189:245-58.
9. Papadakis M, Sharma S, Cox S, Sheppard MN, Panoulas V, ER Behr. The magnitude of sudden cardiac death. Europace. 2009;11:1353-8.
10. Sovari AA, Kocheril AG, McCullough PA. Sudden cardiac death. e-Medicine Cardiology article 151907. 2006:1-9.
11. Kelly DT. Sudden death. Singapore Med J. 1973;14(3):300-1.
12. Drory Y, Turetz Y, Hiss Y, Lev B, Fisman EZ, Pines A, Kramer MR. Sudden unexpected death in persons <40 years of age. American J Cardiol. 1991;68(13):1388-92.
13. Eckart RE, Scoville SL, Campbell CL. Shry EA, Stajduhar KC, Potter RN, et al. Sudden death in young adult: A 25- year review of autopsies in millitry recruits. 2004;141(11):829-34.
14. Lecomte D, Fornes P, Nicolas G. Stressful events as a trigger of sudden death: a study of 43 medico-legal autopsy cases. Forensic Sci Int. 1996;79(1)1-10.
15. Tin LL, Beevers DG, MD, Lip GYH. Hypertension, left ventricular hyperttrophy and sudden death. Curr Cardiol Rep. 2002;4:449-57.
16. Thygesen K, Uretsky BF. Acute ischemia as a trigger of sudden cardiac death. Eur Heart J Supp. 2004;6(Supp D):D88-90.
17. Zheng ZJ, Croft JB, Giles WH. Sudden cardiac death in the United States. 1989 to 1998 by American Heart Association, Circulation. 2001;104:2158-63.
18. Bunch TJ, Hohnloser S, Gersh B. Mechanism of sudden cardiac death in myocardial survivors. Circulation. 2007;115:2451-7.

Cite this article as: Shah PA, Gamit B, Dalal C, Shah P. Pattern of mortality in sudden death: An autopsy study. Int J Community Med Public Health 2017;4:792-6.