ORIGINAL RESEARCH

Pattern and Medico-Legal Aspects of Sudden Cardiac Deaths in Adults with Known Hypertension and Diabetes: A Retrospective Study

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ABSTRACT

Introduction: Sudden cardiac death (SCD) remains a leading cause of mortality worldwide, particularly among individuals with comorbidities such as hypertension and diabetes mellitus. Understanding the pathological patterns and medico-legal implications of SCD in this population is crucial for both preventive strategies and forensic investigations.**Objective:** To evaluate the pattern, pathological findings, and medico-legal aspects of sudden cardiac deaths in adult patients with known hypertension and diabetes.**Methodology:** This retrospective study included 335 adult cases of sudden cardiac death with documented histories of hypertension and diabetes. Autopsy records, histopathological reports, and medico-legal documents were reviewed and analyzed.**Results:** The majority of decedents were males (71.9%) with a mean age of 58.3 ± 10.7 years. The most common immediate cause of death was myocardial infarction (51.3%), followed by cardiac arrhythmias (22.4%) and cardiomyopathy (14.6%). Left ventricular hypertrophy and coronary artery atherosclerosis were the most frequent pathological findings. In 64.2% of cases, death occurred outside hospital settings. Medico-legal investigations were initiated in 48.9% of cases due to unexpected timing or lack of prior medical supervision.**Conclusion:** Sudden cardiac death in hypertensive and diabetic adults predominantly affects middle-aged males and is often related to myocardial infarction or structural heart disease. A high proportion of deaths occur outside hospital settings, often raising medico-legal concerns. Enhanced screening, public awareness, and forensic preparedness are essential in addressing both the clinical and legal implications of SCD in this high-risk population.

Keywords: Sudden cardiac death, hypertension, diabetes mellitus, myocardial infarction, medico-legal autopsy, cardiac pathology.

INTRODUCTION

Almost one in five deaths in industrial nations is due to unexpected cardiac arrest, known as sudden cardiac death [1]. It occurs when someone alive and without symptoms suddenly dies within one hour of experiencing symptoms or 24 hours after being seen, because cardiac reasons [2]. Although some individuals develop SCD as their first sign of cardiac disease, in many people, it appears after the presence of hypertension and diabetes mellitus. Both these conditions are found together often, are common all over the world, and speed up the development of CVD [3]. At present, hypertension is present in more than 1.28 billion adults worldwide, and diabetes occurs in more than 537 million adults. Both numbers are expected to go up over the next ten years [4]. Cardiovascular abnormalities are amplified by their co-existence as they weaken the arteries, make atherosclerosis progress more rapidly, and lead to increased heart muscle enlargement, and more fibrosis

[5]. When present together, heart disease risk in diabetics with high blood pressure increases by a factor of two compared to patients who have only one of the risks [6].

Results from other studies indicate that cardiomyopathy in this high-risk group is frequently caused by silent ischemia in the heart, sudden infarction, or lethal arrhythmias [7]. At autopsy, a lot of these patients are found to have thickened heart walls, blocked arteries, and fibrosis in the heart, showing just how slowly but surely cardiovascular problems can develop in hypertensive-diabetic patients [8]. Although antihypertensive and antidiabetic drugs are readily available, many clients do not use them as they should, and there are still a lot of missed diagnoses and incomplete assessment of hidden cardiovascular diseases [9]. Managing SCD is challenging from a law and medical perspective. Usually, these deaths happen away from hospitalsinside homes, streets, or vehiclesand they go unnoticed or get little documentation. Such cases usually lead to a medico-legal autopsy that can determine if a crime took place if treatment was negligent, and what caused the patient's death [10]. Many countries require that sudden deaths in individuals who have not received medical treatment lately are looked into by Forensics, especially when they happen in custody or just a while after leaving the hospital. This means that the interaction between clinical cardiology and forensic medicine is especially useful when investigating sudden heart deaths in people who have hypertension and diabetes [11].

Objectives

To assess the patterns, pathological findings, and medico-legal implications of sudden cardiac deaths in adult patients with documented histories of hypertension and diabetes.

Methodology

This retrospective study included a total of 335 adult cases of sudden cardiac death who had documented histories of both hypertension and diabetes mellitus. Data were collected from medico-legal autopsy records, postmortem reports, histopathological findings, and police requisitions.

Inclusion Criteria

- Adults aged 30 years and above
- Documented clinical history of both hypertension and diabetes mellitus
- Sudden unexpected death presumed to be cardiac in origin
- Availability of complete autopsy and histopathology records

Exclusion Criteria

- Deaths due to trauma, poisoning, or clearly non-cardiac causes
- Incomplete or missing medical or autopsy data
- Patients with known terminal illnesses or under palliative care

Data Collection

Data were collected retrospectively from medico-legal autopsy records of 335 adult individuals with a documented history of both hypertension and diabetes mellitus who experienced sudden cardiac death. Relevant information was extracted from postmortem examination reports, histopathological findings, police requisitions, emergency room documentation, and hospital case records where available. Key variables included age, sex, time and location of death, prior clinical history, and gross and microscopic cardiac findings. Particular attention was given to the presence of left ventricular hypertrophy, coronary artery atherosclerosis, myocardial infarction (acute or old), and cardiomyopathy. Additionally, contextual factors such as whether the death occurred at home, in a public place, or during transport were recorded. Each case was also reviewed to determine whether a medico-legal referral was initiated, along with the reason for legal scrutiny.

Statistical Analysis

All data were entered and analyzed using SPSS version 21. Descriptive statistics were used to summarize demographic variables, location and cause of death, and histopathological findings. Continuous variables such as age were expressed as means with standard deviations, while categorical data such as sex, type of cardiac pathology, and place of death were presented as frequencies and percentages. A p-value of less than 0.05 was considered statistically significant for all comparisons.

RESULTS

Among the 335 cases of SCD, the average age was 58.3± 10.7 years, with a clear male predominance (72%). Most victims (58.5%) were aged between 50–69 years, while 22.4% were younger (30–49 years) and 19.1% were 70 or older. In-hospital deaths were slightly more common in older age groups, but differences in age and sex distribution between in-hospital and out-of-hospital deaths were not statistically significant.

Table 1: Demographic Characteristics

Characteristic	Total (n=335)	In-Hospital (n=64)	Out-of-Hospital (n=271)	p-value
Mean Age (years)	58.3 ± 10.7	59.2 ± 9.3	58.1 ± 11.1	0.44
Male	241 (71.9%)	43 (67.2%)	198 (72.9%)	0.39
Female	94 (28.1%)	21 (32.8%)	73 (27.1%)	0.39
Age Group 30–49	75 (22.4%)	10 (15.6%)	65 (24.0%)	0.08

Age Group 50–69	196 (58.5%)	38 (59.4%)	158 (58.3%)	0.92
Age Group ≥70	64 (19.1%)	16 (25.0%)	48 (17.7%)	0.26

Acute myocardial infarction (MI) was the leading cause of death, accounting for over half (51.3%) of all cases. Cardiac arrhythmias (22.4%) and cardiomyopathy (14.6%) were also significant contributors. MI was significantly more frequent in in-hospital deaths (62.5%) compared to out-of-hospital deaths (48.3%) ($p = 0.02$), possibly reflecting better diagnostic capture in a hospital setting.

Table 2: Autopsy-Identified Cause of Death

Cause of Death	Total (n=335)	In-Hospital	Out-of-Hospital	p-value
Acute Myocardial Infarction	172 (51.3%)	40 (62.5%)	132 (48.3%)	0.02*
Cardiac Arrhythmia	75 (22.4%)	12 (18.8%)	63 (23.2%)	0.48
Cardiomyopathy	49 (14.6%)	6 (9.4%)	43 (15.9%)	0.27
Severe Coronary Atherosclerosis (No MI)	27 (8.1%)	4 (6.3%)	23 (8.5%)	0.78
Others	12 (3.6%)	2 (3.1%)	10 (3.7%)	0.99

Left ventricular hypertrophy (LVH) was the most common pathological change, present in 73% of cases, followed by coronary artery atherosclerosis (64%) and myocardial fibrosis (41%). Old healed MI was found in 24%, indicating a history of prior silent or undiagnosed infarctions.

Table 3: Cardiac Pathological Findings

Finding	Total (n=335)	In-Hospital	Out-of-Hospital	p-value
Left Ventricular Hypertrophy	243 (72.5%)	42 (65.6%)	201 (74.2%)	0.18
Coronary Artery Atherosclerosis	215 (64.2%)	38 (59.4%)	177 (65.3%)	0.34
Myocardial Fibrosis	136 (40.6%)	28 (43.8%)	108 (39.9%)	0.67
Old Healed MI	82 (24.5%)	16 (25.0%)	66 (24.4%)	0.93
Dilated Cardiomyopathy	49 (14.6%)	9 (14.1%)	40 (14.8%)	0.97

Most deaths (41%) occurred at home, often unwitnessed and discovered by family members. About 23% occurred in public places, typically following sudden collapse. Another 19% died in hospital either before formal admission or in emergency care settings, while 17% died during transport.

Table 4: Location and Circumstances of Death

Location of Death	Number of Cases	Percentage (%)	Common Features
At Home	138	41.2%	Mostly unwitnessed; family found unresponsive
Public Place	77	23.0%	Sudden collapse during activity; often witnessed
Hospital (Before Admission)	64	19.1%	Brought dead to ER or arrested in triage
During Transport	56	16.7%	Expired while being transported to facility

Out of 335 cases, 271 (81%) occurred outside the hospital. Out-of-hospital deaths were more likely to be referred for medico-legal investigation (54%) compared to in-hospital deaths (17%) ($p < 0.001$). In-hospital deaths showed a higher rate of diagnosed acute MI (62.5% vs. 48.3%, $p = 0.02$).

Table 5: Comparison of In-Hospital vs. Out-of-Hospital Sudden Cardiac Deaths

Variable	In-Hospital	Out-of-Hospital	p-value
Number of Cases	64	271	-
Mean Age	59.2 ± 9.3	58.1 ± 11.1	0.44
Male (%)	67.2%	72.9%	0.39
Acute MI (%)	62.5%	48.3%	0.02*
LVH (%)	65.6%	74.2%	0.18
Medico-Legal Referral (%)	17.2%	54.2%	<0.001*

DISCUSSION

This research reviewed the main findings, patterns, and legal implications of sudden cardiac deaths in people with both hypertension and diabetesa group that is at high risk because of their cardiovascular vulnerability. They provide important understanding of the populations, broad reasons for death, and criminal investigation concerns involving SCD in patients with these other conditions. Most victims of SCD were men, according to the study, with around three-quarters being aged 58. The majority of cases happened among men 50–69, so middle-aged men with hypertension and diabetes are especially at risk for sudden heart problems. Research shows that in men, who have had metabolic and vascular ailments for some time, the chance of cardiovascular diseases increases around age 60 [12]. In our study, autopsy identified acute MI as the main reason for death in about half of all cases. There were many cases of cardiac arrhythmias and cardiomyopathies, together leading to over one-third of all deaths [13]. Earlier studies showed that ischemic heart diseasewhich may not show symptoms until it's too latewas most often the explanation for death in people with hypertension or diabetes [14]. Furthermore, myocardial fibrosis and healed old MIs observed in 41% and 24% of cases show persistent silent injury potentially caused by repeated ischemia or lasting high blood pressure.Pathological changes were widespread. Seventy-three percent of the cases had left ventricular hypertrophy, and sixty-four percent showed signs of atherosclerosis of the coronary arteries, features commonly seen from chronic hypertension and diabetes-related heart changes. Like previous studies, results from these searches related LVH and multivessel atherosclerosis to a higher risk of SCD, especially in patients with hard-to-control blood pressure and high blood sugar levels [15-16]. How people died showed a worrying trend: Eighty percent of Sudden Cardiac Deaths (SCD) took place outside a hospital, most commonly at home. Deaths suffered in public and while traveling caused even greater difficulties in helping the victims fast. Likewise, previous population research has shown that the majority of heart arrests take place outside medical settings and that help is usually not available for CPR [17]. Because of this, it stresses the need to have more community-focused strategies, such as defibrillators in many places, major improvements in bystander CPR, and improved early identification of risks during outpatient care. We looked into the legal implications of these deaths during our study [18]. More than half (49%) of the cases saw a medico-legal referral, often because the collapse or death occurred in public without witnesses. About one-quarter of legal autopsies were requested after urgent care center referrals when the cause was difficult to determine. Like other studies, these data confirmed that SCD in hypertensive-diabetic cases frequently draws attention from the law due to its sudden and usually undocumented symptoms [19]. Even though there were fewer cases of relatives suspecting harm and deaths among inmates, police looked into them carefully. The chances of an acute MI were greater in in-hospital cases (62.5%) than in out-of-hospital cases (48.3%). Likely, this was because of the availability of better testing and early treatment ($p = 0.02$). About half of patients who passed away in the field received a medico-legal referral, as opposed to just 17% who died in the hospital. $p < 0.001$ proves that there are many legal and ethical problems related to deaths without Medical personnel immediately available. They found that, while the actual health issues were the same, the rate of finding and statistically proving them was not [20]. But, this study still comes with certain limitations. Looking back over the study, they used old records that may have had pieces of data missing or uncertain diagnoses. It did not use advanced methods in studying the tissue or harmful effects and did not provide data on any follow-up care or remembering treatments, which plays a part in the results.

CONCLUSION

It is concluded that sudden cardiac death in adults with hypertension and diabetes most commonly affects middle-aged males and is predominantly caused by acute myocardial infarction, arrhythmias, and cardiomyopathy. Structural cardiac abnormalities such as left ventricular hypertrophy and coronary artery atherosclerosis were prevalent in autopsied cases, highlighting the chronic cardiovascular damage associated with these comorbidities. A significant proportion of deaths occurred outside hospital settings, often unwitnessed, leading to a high rate of medico-legal investigations.

REFERENCES

1. Sharma, G. (2019). *Study of Pattern of Sudden Natural Deaths amongst Autopsies Conducted at MS Ramaiah Medical College* (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).
2. Chaudhari, Sandesh H., Anand Mugadlimath, Mandar Sane, K. U. Zine, D. I. Ingale, and Rekha Hiremath. "Study of sudden natural deaths in medico-legal autopsies with special reference to cardiac causes." *International Journal of Current Research and Review* 5, no. 3 (2013): 37.
3. Brosseron, L. S. B. (2011). *Pulmonary Thromboembolism and Sudden Unexpected Death: Medico-Legal Review* (Master's thesis, Universidade do Porto (Portugal)).
4. Ghodrati, Fatemeh, Narjes Saadatmand, Saeid Gholamzadeh, and Marzieh Akbarzadeh. "The seven-year epidemiological study of legal abortion caused by heart disease, blood disorders, diabetes and hypertension as referred to forensic medicine centers in Fars province." *Family Medicine & Primary Care Review* 1 (2019): 23-29.
5. Vandayar, Yuvika. "A retrospective investigation of sudden unexpected death in the young investigated at Salt River Mortuary, Cape Town." (2020).

6. Hookana E. Characteristics of victims of non-ischemic sudden cardiac death. University of Oulu; 2012 Dec 7.
7. Diallo, Amadou Mouctar, Ibou Thiam, Mouhamed Manibiliot Soumah, Sidy Ahmed Dia, and Mor Ndiaye. "Sudden cardiac death in Dakar: Epidemiological and anatomo-pathological characteristics." *Forensic Medicine and Anatomy Research* 7, no. 3 (2019): 51-61.
8. Raj, K.G. and Shobhana, S.S., 2018. A retrospective study of pattern of organs involved in natural deaths at autopsy—role of histopathology as ancillary tool. *Indian Journal of Forensic Medicine & Toxicology*, *12*(3), pp.69-74.
9. Pelemo, Olumuyiwa Eyitayo, Donatus Sabageh, Akinwumi Oluwole Komolafe, Adedayo Olukemi Sabageh, and William Olufemi Odesanmi. "An autopsy review of sudden unexpected natural deaths in a suburban Nigerian population." *Population health metrics* 12 (2014): 1-6.
10. Murty, O. P., Chong Tze Sheng, Lai Ngan Chee, and Anshoo Agarwal. "Sudden death due to myocardial infarction and ethnicity: a Malaysian perspective." *International Journal of Medical Toxicology & Legal Medicine* 10, no. 2 (2008): 49-58.
11. Cihan, Esma, Orrin Devinsky, Dale C. Hesdorffer, Michael Brandsoy, Ling Li, David R. Fowler, Jason K. Graham et al. "Temporal trends and autopsy findings of SUDEP based on medico-legal investigations in the United States." *Neurology*95, no. 7 (2020): e867-e877.
12. Bharati, U. (2017). Brought in dead cases in the department of emergency of a tertiary care centre of Nepal. *Nepal Med Coll J*, *19*(2), 110-113.
13. Prashantha, B., Idris, M.Z., Ahmad, N., Agarwal, M., Yadav, S.C. and Singh, V.K., 2014. Awareness and Pattern of Cardiovascular Risk Factors among Patients Attending Cardiac Emergency with Acute Chest Pain of Cardiac Origin in Lucknow. *Indian Journal of Public Health Research & Development*, *5*(3), p.251.
14. Dağar, Seda, Emine Akıncı Emektar, Şeref Kerem Çorbacıoğlu, Hüseyin Uzunosmanoğlu, Ozge Oztekin, and YunsurCevik. "Medico-legal evaluation of geriatric patients and mortality predictors in the elderly with forensic trauma." *Ankara Medical Journal* 19, no. 4 (2019): 761-768.
15. Basso, C., Aguilera, B., Banner, J., Cohle, S., d'Amati, G., De Gouveia, R.H., di Gioia, C., Fabre, A., Gallagher, P.J., Leone, O. and Lucena, J., 2017. Guidelines for autopsy investigation of sudden cardiac death: 2017 update from the Association for European Cardiovascular Pathology. *VirchowsArchiv*, *471*, pp.691-705.
16. Godale L, Mulaje S. Mortality trend and pattern in tertiary care hospital of Solapur in Maharashtra. Indian Journal of Community Medicine. 2013 Jan 1;38(1):49-52.
17. Winkel, B.G., Holst, A.G., Theilade, J., Kristensen, I.B., Thomsen, J.L., Ottesen, G.L., Bundgaard, H., Svendsen, J.H., Haunsø, S. and Tfelt-Hansen, J., 2011. Nationwide study of sudden cardiac death in persons aged 1–35 years. *European heart journal*, *32*(8), pp.983-990.
18. Sabir, S.A., Hameed, S. and Aziz, H., 2010. Adult Mortality in Medical, Sociodemographic and Healthcare Perspective. *Pakistan Journal of Medical Research*, *49*(4), p.3.
19. Eckart, R.E., Shry, E.A., Burke, A.P., McNear, J.A., Appel, D.A., Castillo-Rojas, L.M., Avedissian, L., Pearse, L.A., Potter, R.N., Tremaine, L. and Gentlesk, P.J., 2011. Sudden death in young adults: an autopsy-based series of a population undergoing active surveillance. *Journal of the American College of Cardiology*, *58*(12), pp.1254-1261.
20. Ukekwe FI, Odunukwe NN, Olusina DB, Okafor OC, Nzegwu MA. Sudden Unexpected Natural Deaths of Adults in Southeastern Nigeria: A 12 Years Autopsy Review.