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Article

Characteristics of Sudden Death Cases in the Medical Forensic and Medico Legal Installation in RSUD dr. Moewardi from 2017- 2022

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ABSTRACT

Sudden death represents a significant global health burden that can affect any population. The potential for sudden death to affect any individual at any time underscores the importance of investigating this issue. The findings of this study may serve to reinforce existing evidence regarding sudden death, thereby facilitating the implementation of additional measures in a timely and appropriate manner. The objective of this study is to determine the prevalence of sudden death cases in RSUD dr. Moewardi, from 2017 to 2022, identified the socio-demographic profile of the most vulnerable population groups and ascertained the most predominant system of involvement. Research was conducted with descriptive observational study, cross-sectional design, and purposive sampling. Subject consists of sudden death cases in the Medical Forensic and Medico Legal Installation in RSUD dr. Moewardi from 2017 to 2022. Of the 100 cases, the highest number was observed in 2020, representing 29% of the total cases. Individuals in the pre-elderly age group (39%) and male gender (88%) are most likely to experience sudden death. The primary cause of suspected sudden death is of other systems involvement (57.3%), with the cardiovascular system (54.54%) being the most common cause of sudden death. Sense-related abnormalities are the predominant indicator of past comorbidities in both suspected (56.17%) and sudden death cases (72.72%). The author concluded that pre-elderly male individuals are the most vulnerable to sudden death. The primary cause of suspected sudden death is of the other systems of involvement and the cardiovascular system in sudden death, with sense organ abnormalities being the predominant comorbidity indicator in both instances.

INTRODUCTION

Sudden death is one of the world's most serious health issues, particularly in Asia and Indonesia [1–3]. The incidence and prevalence of sudden death vary widely depending on

the definition and data source. The most widely used definition for sudden death was unexpected death that occurs either within 24 hours of being seen alive and symptom-free (unwitnessed) or within 1 hour of the start of symptoms (event witnessed) [4,5].

To date, the most common cause of sudden death cases worldwide are cardiovascular diseases, yet sudden death is also called sudden cardiac death. Cardiomyopathy, coronary disease, and arrhythmia contribute to the greatest number of deaths from sudden cardiac death. Other causes of death are respiratory diseases, digestive diseases, hematopoietic diseases, genitourinary diseases, endocrine diseases, and other diseases that interfere with the central nervous system, as well as diseases that fall into categories other than the aforementioned. Sudden death is thought to be responsible for 15% to 20% of all fatalities. More than 300.000 deaths annually are categorized as sudden unexpected deaths in the USA and European countries. The highest rate of sudden cardiac death was found in Australia, North America, and Europe (111.9; 98.1; and 86.4 cases per 100.000 population, respectively) [4,6,7]. Sudden death in Asia is relatively low compared to other regions, but findings of risk factors for sudden death show an increasing trend[14,30]. Sudden death can occur to anyone, regardless of age, as well as at any time and place during any kind of activity. Most of them occurred in middle age and older male [2,8.]

The most common risk factors for sudden cardiac death in Asian countries were coronary artery disease (CAD), hypertension, obesity, and diabetes mellitus[9]. The rise in older citizens is thought to cause an increase in cardiovascular diseases, degenerative diseases, diabetes, hypertension, and dietary changes, increasing the risk of health problems like hypertension, dyslipidemia, chronic kidney failure, and obesity [9,10]. Most sudden cardiac deaths occur in older age, especially in Europe and the West Pacific countries. This fact is in contrast to the findings of younger sudden-death patients in Africa, Central and South America, and Southeast Asia. Sudden death cases due to preexisting health conditions may be perceived as suspicious by the public and police investigators, especially if the circumstances are suspicious, such as death outside the deceased's residence or hospital. This is amplified if the deceased is a high-profile individual. As a result, sudden death cases qualify as forensic cases, even if the cause of death is not always criminal [11,12].

Sudden death significantly contributes to years of life lost (YLL) and productivity loss, YLL being a premature mortality indicator that considers age at death and incidence, often used to measure social and economic consequences of mortality in an age-specific manner. A study in Wake County, North Carolina found that heart disease and all cancers combined had a higher YLL than sudden death among natural causes of death. Additionally,

sudden death caused a $51 billion lifetime productivity loss, surpassing the productivity loss from any individual cancer combined[10,26,30]. Taking this into consideration, RSUD dr. Moewardi, specifically the Medical Forensic and Medico Legal Installation, was chosen as the location of this study due to its status as an Advanced Referral Health Facility. Furthermore, Surakarta is a city with a growing working-age population spanning three generations, thus making this location suitable for studying sudden death [13,14].

The research aims to identify the most vulnerable population groups for sudden deaths in Surakarta, Indonesia, and the predominant system of involvement based on pathological features. The research aims to spur collaborative efforts to prevent sudden death cases, especially in vulnerable populations, and educate society on when to be vigilant for potential sudden death risks.

METHODS

This study was approved by the Ethical Committee of Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada with register number KE/FK/1616/EC/2023. This research was conducted with descriptive observational study, cross-sectional research design, focusing on a single variable, referred to as prevalence of sudden death cases in the location of research. As purposive sampling for this study, inclusion and exclusion criteria is used to determine the specific traits needed for the sample. The inclusion criteria for this study were the Visum et Repertum along with its cover letter and chronology of sudden death cases due to illness, verified through either autopsy or external examination, with complete variables (sex, age, cause of death and past comorbidities) in the report, taken from the Medical Forensic and Medico Legal Installation of RSUD dr. Moewardi between 2017 to 2022, while the exclusion criteria were the Visum et Repertum of cases of sudden death with indications of alcohol intoxication, drug abuse and poisoning, as well as the as the Visum et Repertum of sudden death cases that had been damaged in a manner that obscured some of the observed components, taken from Medical Forensic and Medico Legal Installation of RSUD dr. Moewardi between 2017 to 2022. The sample size is calculated using the Slovin formula and the sample size obtained is 100 subjects.

This study uses secondary data from the Visum et Repertum of sudden death cases from the Medical Forensic and Medico Legal Installation of RSUD dr. Moewardi, collected between 2017-2022, with the instruments being utilized for this study consisting of: 1) Visum et Repertum data from the Medical Forensic and Medico Legal Installation in RSUD dr. Moewardi from 2017-2022, 2) Checklist for data collection and summarization and 3)

Microsoft Excel 2021 software, utilized for data analysis. The data collected will be analyzed using univariate analysis, which will be summarized using narrations and figures to provide interpretation and structure of the quantitative data.

RESULTS

The subjects that have met the inclusion criteria are one hundred Visum et Repertum reports from the Medical Forensic and Medico Legal Installation in RSUD dr. Moewardi from 2017 to 2022. Most sudden death cases were found in 2020 (Table 1).

Table 1. Number of Sudden Death Cases

	Number of Cases (n)	***Percentage (%)***
Year		
2017	14	14.0
2018	10	10.0
2019	19	19.0
2020	29	29.0
2021	12	12.0
2022	16	16.0
Total	100	100.0
Sex		
Male	88	88.0
Female	12	12.0
Total	100	100.0
Age of Death (Mean±SD : 52.08±15.94)		
Children	2	2.0
Adult	23	23.0
Pre-Elderly	39	39.0
Elderly	36	36.0
Total	100	100.0
Type of Examination		
External Examination	89	89.0
Autopsy	11	11.0
Total	200	100.0

Table 2. Suspected System of Involvement

Cause of Death	***Number of Cases (n)***	***Percentage (%)***
Cardiovascular System	6	6.74
Respiratory System	3	3.37
Digestive System	2	2.25
Hematopoietic System	0	0.0
Urogenital System	0	0.0
Endocrine System	4	4.49
Central Nervous System	3	3.37
Others	51	57.3
Unknown	20	22.47
Total	89	100.0

Pre-elderly males were the most vulnerable population group related to sudden death. Autopsies are only performed on a small proportion of patients, even though establishing the cause of death in sudden death requires an autopsy (Table 1). Findings in other body parts are described in Tables 4 and 5.

The suspected and the exact cause of death from the autopsy appear consistent with cardiac abnormalities as the primary finding (Tables 2 and 3)

Table 3. System of Involvement

Cause of Death	***Number of Cases / Percentage***
Cardiovascular System	6 / 54.54
Respiratory System	3 / 27.27
Digestive System	2 / 18.18
Total	89 / 100.0

Table 4. Signs of Past Comorbidities

Past Comorbidities	***Present (n)***	***Not Present (n)***
Skin-Related Abnormalities	0	11
BMI-Related Abnormalities	4	7
Overweight	3	1
Obese	1	3
Limb-Related Abnormalities	1	10
Upper Arm Redness	1	0
Sense-Related Abnormalities	8	3
Palpebral Tardieu Spots	4	4
Reddish Conjunctiva	1	7
Conjunctival Vessel Dilation	1	7
Conjunctival Hemorrhage	1	7
Under Eye Laceration	1	7
Cyanosis	1	7
Tongue Protrusion	1	7
Others (Personal Effects, etc.)	0	11

The autopsy results (Table 3 and Table 4) indicate that the cardiovascular system was the most frequently involved cause of death (54.54%), followed by the respiratory system (27.27%) and the digestive system (18.18%). Regarding past comorbidities, BMI-related abnormalities and obesity were observed in some cases, while most other comorbid signs were less frequently present. Table 5 shows that the most common past comorbidities were sense-related abnormalities (56.8%), BMI-related abnormalities (17.0%), and limb-related abnormalities (6.8%). Palpebral Tardieu spots were observed in 34.1% of cases, while personal effects were noted in 18.2%. Other conditions, such as cyanosis (5.7%) and tongue protrusion (2.3%), were less frequently present.

DISCUSSION

Sudden death is a death incidence that occurs within 1 hour after the onset of witnessed symptoms or 24 hours if unwitnessed [12,15]. Many authors associate sudden death with unexpected and unexplained death, so this condition needs to be investigated with an autopsy [16]. Sudden death is strongly correlated with heart pathology findings, so sudden death is often referred to as sudden cardiac death. Patients with sudden death can be found in the community, public places, and even in the health facilities. The results of this study are also in line with the results of previous studies with heart disease as the most common finding [1,7,11].

Table 5. Signs of Past Comorbidities

Past Comorbidities	***Present (n)***	***Not Present (n)***
Skin-Related Abnormalities	8	81
Ulcus Decubitus	3	5
Melanoma Spots	1	7
Bruising	1	7
Hyperpigmentation	1	7
Coining Therapy Marks	1	7
Cyanosis of the Lips	2	6
BMI-Related Abnormalities	14	75
Overweight	11	3
Obese	3	11
Limb-Related Abnormalities	6	83
Presence of Wound	1	5
O-Shaped Legs	1	5
Bruising	2	4
Blistering	1	5
Amputation Marks	1	5
Sense-Related Abnormalities	50	39
Palpebral Tardieu Spots	30	20
Conjunctival Tardieu Spots	1	49
Reddish Conjunctiva	19	31
Conjunctival Vessel Dilation	4	46
Cyanosis	5	45
Foaming of the Nose	7	43
Foaming of the Mouth	6	44
Tongue Protrusion	2	48
Upper Lip Laceration	1	49
Bitten Lower Lip	1	49
Others (Personal Effects, etc.)	16	73
Presence of Mass	3	13
Ascites	1	15
Jugular Vein Distention	1	15
Fractured Teeth	1	15
Others Additional Information from Personal Effects	2	14
Additional Information from Medical Record or Testimony from Family Members and/or Witnesses	9	7

Most of cases found in 2020, when Covid-19 cases increased drastically worldwide and WHO declared Covid-19 as the new pandemic. Covid-19 related to many complications tend to cause sudden death, but in this study the author did not analyze the relationship between Covid-19 and sudden death. Respiratory and heart disorders are thought to have worsened patient condition and became a major risk factor the cause of death [3,17]

A pre-elderly male (45-59 years old) has the highest chance of experiencing sudden death, especially of the cardiovascular system. Older individuals over the age of 45 are more likely to experience Sudden Cardiac Death (SCD), while the same instance happening in younger individuals are more likely due to genetic factors or lifestyle choices like drug abuse. Approximately 40% of SCD cases have no discernible cause at postmortem, usually due to hereditary arrhythmia diseases. Though middle-aged men are up to four times more prone to experiencing sudden death than females, a study in Australia and New Zealand found that of the 28% female SCD cases being procured, women are more likely to experience unexplained deaths after postmortem examination when compared to their male counterpart, with cases such as these typically associated with hereditary arrhythmia syndromes [1,2,6,18].

External examinations were the preferred method in 89 out of 100 observed cases (89%), while autopsy was used in 11 cases (11%). Although the Indonesian Criminal Code article 184 and article 183 had established the basis for autopsy and criminal proof in Indonesia, requiring at least two pieces of evidence including expert information like a Visum et Repertum report, both family members and the police force are allowed to submit a written request to either conduct an autopsy, only conduct an external examination or to reject an autopsy request altogether, provided they are aware of potential consequences and agree to not pursue charges for future events related to the incident [12,19,20].

Religious objections are a major reason why family members of the deceased may reject an autopsy request. These objections can range from minor to significant, based on religious customs, fear of body disfigurement, and concerns regarding the spiritual health of the remaining family members if they feel like they were neglecting to follow rules for burial and preparation, which is believed to hinder the deceased's transition to the afterlife [12,20,21]. Cultural factors in Indonesia may also influence law enforcement, including the implementation of autopsy procedures. The deceased's perceived dignity and religious customs may dictate that they should not be seen in a decomposed state as to avoid slander. Family members may reject autopsy requests due to a lack of information about Visum et Repertum usage and their importance, especially if an internal examination is planned. This

cultural factor is considered one of five factors influencing law enforcement in Indonesia [22].

The most prevalent system of involvement in suspected sudden death cases is other systems of involvement with a total of 51 cases, or 57.3% of 89 cases, with asphyxia being the leading suspected cause. Asphyxia, derived from the Greek term "stopping of the pulse," refers to a complex group of conditions where tissues or cells in the body do not receive enough oxygen to absorb and use, often alongside carbon dioxide retention [23,24]. Asphyxia occurs when blood circulation in vital organs, such as the brain and heart, is insufficient, leading to terminal death. Investigating asphyxia deaths is challenging due to the delicate nature of findings and the absence of a specific pathognomonic indication, as well as the fact that the cause in each case may vary widely as oxygen deprivation-induced conditions or injuries has the potential to be present in a variety of fatalities, regardless of the root cause. With that said, an autopsy involving an internal examination is necessary to determine an exact cause of death [25,26].

The cardiovascular system is the primary cause of sudden death cases, accounting for 6 out of 11 cases (54.54%). This is in accordance with the number of global incidences of sudden death related to the cardiovascular system. In the United States, an estimated 0.1% of the population experiences an out-of-hospital cardiac arrest annually. European studies report similar incidences, while Australian studies estimate SCD incidences range from 34.6 to 89.1 per 100,000. In Douala, Cameroon, SCD rates are around 33.6 per 100,000. China has an incidence of 41.8 per 100,000, while India has an incidence of 39.7 per 100,000 in individuals over 35 years old.

Sense-related abnormalities were the most common cause of suspected sudden death in both cases (57.3%) and (72.72%), with palpebral tardieu spots being the primary feature in 30 out of 51 cases (58.82%) and 4 out of 8 cases (50%), respectively. Tardieu spots, caused by an acute increase in venous pressure, are part of the three cardinal signs of asphyxia, alongside cyanosis and facial congestion and/or edema, which is in line with asphyxia being the primary cause of suspected sudden death[10,24]. Skin-related abnormalities were found in 8 out of 89 cases (8.98%) of suspected sudden death cases, with ulcus decubitus accounting for 3 out of 8 cases (37.5%) and not found in any of the sudden death cases. This feature is found in cases of chronic illnesses such as diabetes mellitus (2 cases) and both hypertension and breast cancer of an unspecified grade (1 case). BMI-related abnormalities were found in 14 out of 89 cases (15.73%) of suspected sudden death and 4 out of 11 cases (36.36%) of sudden death, accounting for cases with the deceased being overweight and obese at the time of death. Overweight cases are more common than obese cases, though both contribute to increased health risks like stroke, heart disease, high blood

pressure, and type 2 diabetes[14,29,30]. Aside from 1 out of 6 cases (16.66%) with the deceased bearing amputation marks on both legs, limb-related abnormalities provide minimal information about the past comorbidities of the deceased, but some features provide details about the circumstances of death, such as the position or the place when the sudden death occurred [27,28].

Other signs of past comorbidities that are observed come from other abnormalities that did not belong to the previous categories, such as the deceased's personal effects like clothing or belongings that were brought during the time of death, as well as preexisting medical records or testimony from family members and/or witnesses. In 89 suspected sudden death cases, 15 cases (16.85%) contain signs of past comorbidities; 9 cases (60%) of these signs come from preexisting medical records or testimony from family members and/or witnesses, suggesting that to some degree, family members and others in the deceased's surroundings are aware of their health condition. Observed cases often lack clear signs of past comorbidities, but those that do can help identify possible causes of death, particularly in cases of suspected sudden death. For instance, one case showed that the deceased was carrying Furosemide in his bag, suggesting a chronic illness before death. Another case showed signs of melanoma, a skin cancer, which may be possibly related to the sudden death of the deceased. Written testimony from family and close relatives also provides a better picture of their past medical history and related afflictions. However, as ascertaining the cause of death without an internal examination is challenging, this research relies on circumstantial evidence [29,30].

CONCLUSION

Pre-elderly individuals (39%) and males (88%) are the most vulnerable groups to sudden death, highlighting the significant influence of age and gender on mortality risk. The primary suspected cause of sudden death is respiratory system disorders (59.55%), while confirmed sudden death is predominantly caused by cardiovascular diseases (54.54%). These findings emphasize the crucial role of both respiratory and cardiovascular health in preventing sudden fatalities. Additionally, sensory organ abnormalities are the most common past comorbidity, present in 57.30% of suspected cases and 72.72% of confirmed cases, suggesting a potential link between sensory impairments and an increased risk of sudden death. Given these insights, early detection and management of respiratory and cardiovascular conditions, as well as close monitoring of individuals with sensory impairments, are essential preventive measures, particularly for pre-elderly and male populations.

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