Original article

Sudden unexpected deaths of young adults in a tertiary care hospital for a period of four years

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Abstract

Introduction
Sudden unexpected natural death of a young adult is rare, but has a disproportionate impact on the community. This always requires a systematic forensic autopsy. At the completion of the autopsy it is expected to have the answers for all unanswered questions. However it is a challenge to the forensic pathologist since there are many sudden deaths without significant morphological anomalies.

Objective:
The aim of the study was to identify the causes and characteristics of sudden death among the young adults (less than 40 years of age)

Study Design:
Retrospective descriptive study was done based on the reports of post mortems performed on young adults who had died suddenly and unexpectedly due to natural reasons during past 4 years. The information was gathered on a pro-forma to fulfill the objectives. The data was analyzed using SPSS statistical package version 18.

Results:
Out of 54 autopsies analyzed, 78 % were males. 39% of the victims were of the age group of 36 to 40 years. 33% of the victims were brought to hospital before death. In 76% of the cases, a cause of death could be identified after macroscopic autopsy examination and the percentage increased to 89% after microscopy. Microscopy revealed or confirmed the cause of death in 52% of the cases. 44% were victims of sudden cardiac death. Cause of death was unascertained at the end of all the investigations in 11% of the cases.

Conclusion:
Cause of death has a cardiac origin in majority of sudden unexpected deaths in young adults in the sample examined. Macroscopic autopsy examination could identify a cause of death in majority while abnormalities identified at microscopic examination accounted for death in nearly half of the sudden unnatural deaths in young adults.

Key words: *sudden natural death, young, autopsy, microscopy, cardiac, unascertained*

Introduction

From a forensic point of view, a sudden death is defined as a rapid, natural and unexpected death [1]. Sudden unexpected natural death of a young is rare, but has a disproportionate impact on the community. The incidence of sudden natural deaths among the 1-40 year age group, is reported as 1.3 to 8.5 per 100 000 person years [2,3] while the incidence of sudden death in the general population is reported as 1 in 1000 individuals[4]. Sudden death of a young adult is a tragedy to the family and always requires systematic forensic autopsy performed by a pathologist. It is expected to have the answers for all unanswered questions at the completion of the autopsy. Historical evidence obtained from the witnesses and the family members of the deceased is crucial for this investigation. Recent symptoms prior to death and past medical history and the family history must be probed. Notes of resuscitation and the hospital records are also useful.

Recent autopsy studies have revealed coronary artery disease as the major cause of death in people aged more than 35 years while cardiomyopathies are commonly seen in younger age groups (less than 35 years of age). Arrhythmogenic right ventricular cardiomyopathy is an increasingly recognized type of cardiomyopathy causing sudden deaths in young adults [5]. Diagnosis of these cardiomyopathies at the autopsy plays an important role to counsel and screen the first degree relatives.

However, since all sudden deaths are not thoroughly autopsied, extracardiac causes are not well estimated [5].There are many cases of sudden deaths without significant morphological anomalies. Thus, a significant number of sudden deaths remain as autopsy negative sudden unexplained deaths even after a through autopsy. Presently due to the advancement of molecular biology, many such autopsy negative sudden unexplained deaths have ended up with a pathogenic basis worldwide [6]. An accurate diagnosis through a molecular autopsy, directs initiation of preventive strategies among the relatives. However, the molecular studies are still new and not available to the forensic community of Sri Lanka due to its high cost.

Objective:

The aim of the study was to identify the presentation, causes, and characteristics of sudden death among the young (less than 40 years of age) with a view to have an insight into the causation in our community and to make suggestions to improve the standards in our investigation process.

Method:

Retrospective descriptive study was performed based on the recorded historical evidence and the reports of the post mortems done on young adults who had died suddenly and unexpectedly due to natural reasons during past 4 years. The information was gathered on a pro-forma to fulfill the objectives. The data was analyzed using SPSS statistical package.

Results:

Out of the 54 autopsy cases studied, 42 (78%) were males and 12 (22%) were females. 21 (39%) were of the age group of 36 to 40 while there were 11 (20%) each for the age groups of 21-25 and 31-35. (Table:1)

Table 1: Age distribution of the group

Age group	Frequency	Percentage (%)
<20 yrs	5	9
20-25 yrs	11	20
26-30 yrs	6	11
31-35 yrs	11	20
36-40 yrs	21	39
Total	54	100%

Most deaths (43%; n=9 out of 21) in the age group of 36 to 40 were due to ischaemic heart disease and majority of deaths (50%; 9 out of 18) due to ischaemic heart disease are also coming under this age group.18 (33%) of the group were hard working manual labourers while there were 12 (22%) office workers. (Table: 2)

Table 2: Occupation of the victims

Occupation	Frequency	Percent (%)
Manual labourer	18	34
Office worker	12	22
Student	5	9.
Other	19	35
Total	54	100

29(54%) were smokers. Ethanol abuse was observed among 29 (54%).

40 (74%) had some form of ill health prior to death. Out of these 40, 15 (28%) were suffering from some illness for less than 1 day. 13 (24%) had some form of ill health for 2 days to 1 week. There were 14 (26%) with no complaints of any ill health. However 13 (24%) out of them had a diagnosed chronic condition for years.(Table: 3)

Table 3: Duration of ill health

Duration of ill health	Frequency	Percent (%)
<1day	15	28
1day	2	4
2days-1wk	13	24
1 wk-2wk	5	9
>2wk	5	9
Diagnosed for years but no recent ill health	13	24
None	1	2
Total	54	100

Chest pain was observed by the next of kin in 8 (15%) of the victims while14 (26%) had shortness of breath. Symptoms were nonspecific in 15 (28%).

24 (44%) had consulted a doctor for the ill health.18 (33%) were brought to hospital prior to death. 14 (26%) had a witnessed collapse while 12 (22%) died at sleep.(Table: 4)

Table 4: Presentation

Death occurred	Frequency	Percent
Died at sleep	12	22
Witnessed collapse	14	26
Brought to hospital	18	33
Died on the way to hospital	2	4
Died at work	1	2
Other	7	13
Total	54	100.0

At the end of the gross examination a cause of death was found in 41 (76%) of the cases while at completion of the microscopic examination the cause of death could be identified in 48 (89%). Macroscopic or gross autopsy examination revealed cardiac findings in 27 (50%) while 9 (17%) had nonspecific findings and 8 (15%) had none. (Table: 5)

Table 5: Autopsy findings –macroscopy

Macroscopic findings at autopsy	***Frequency***	***Percent (%)***
Cardiac	*27*	*50*
Other	*10*	*18*
Nonspecific	*9*	*17*
None	*8*	*15*

Microscopy had been done in 34 (63%) of the cases and 6 (11%) had no significant microscopic findings. The cause of death was revealed or confirmed by microscopy in 28 (52%) cases. Microscopic examination revealed 3 cases of myocarditis and 4 cases of recent myocardial infarction where gross examination revealed nonspecific or negative findings. Thus, following microscopy, positive cardiac findings further increased and a total of 34 (63%) were observed to have cardiac findings at the end.

Cardiac findings observed either macroscopically and microscopically were coronary artery disease in 17(31%) cases with associated thrombosis in 6 of them. A recent myocardial infarction was observed in 5 cases

(9%). Myocardial fibrosis with no recent infarction was noted in 6(11%) cases and 3(6%) had isolated myocardial hypertrophy while there were 8 others with myocardial hypertrophy associated with other cardiac findings.

Cardiac causes accounted for deaths in 22 (41%) cases while 6(11%) had negative autopsy after toxicological and microscopic studies.(Table:6)

Table 6: Cause of death

Cause of death	Frequency	Percent (%)
Sudden cardiac death	22	41
Non cardiac	26	48
Unascertained	6	11
Total	54	100

Discussion:

The etiologies of sudden death of young vary among studies [7-10]. Unexplained case of sudden natural death of a young individual has a great impact on the living relatives. With the advancement of science, new methods to screen for risk factors of sudden adult deaths are available [11]. However, without a proper understanding into the etiologies in our own community, population screening methods cannot be planned. Inadequate or inconsistent investigation of young sudden deaths, results in failure to identify potentially fatal, yet treatable familial disease. A detailed investigation of sudden death in the young can reveal hereditary cardiac disease in more than 40% of the cases [12, 13]. Systematic forensic autopsy and autopsy based studies are extremely important for this purpose.

Study revealed that 78% of the victims of sudden natural death are males. The mortality rate for sudden cardiac death per 100,000 person-years was observed as 6.7 for males and 1.4 for females in an autopsy-based series of a population undergoing active surveillance [14].Most of the sudden deaths due to ischaemic heart disease belonged to the age group of 36 to 40. A similar picture was observed in a study done in India where majority were towards the upper limit of the age group [15]. Majority of deaths due to ischaemic heart disease are coming under this age group. Puranik R. et al found in their study, more than two thirds of deaths caused by acute myocardial infarction occurred in the age group from 30-35 years [16]. 33% of the group were hard working manual labourers. Exertion acts as a trigger for lethal ventricular tachyarrhythmias, especially when there is underlying cardiac disease [17-19]. Literature reveals that the reported cases of sudden deaths among the young athletes are on the rise [20]. More than half of the victims were reported smokers and also there were more than half with a history of ethanol abuse. Cigarette smoking is a known risk factor for sudden cardiac death. Similarly, heavy alcohol consumption is associated with an increased risk of sudden cardiac death [21, 22].

74% of the group reported to have some form of ill health prior to death. Mostly the symptoms were nonspecific and of a short duration. However in a study on prodromal symptoms only 18% had symptoms prior to death [23]. The recorded prodromal symptoms in this group are based on statements made by the relatives who at this desperate moment, try to relate their loved one's death to some form of illness. However chest pain and shortness of breath were observed in 41%. Further, 44% had consulted a physician for their ill health prior to death which has to be considered important.

33% was brought to hospital prior to death while 26% had a witnessed collapse.22% of the deaths had occurred while at sleep. DeVreede Swagemakers JJM had reported that 40% of sudden deaths can be un-witnessed[24].

Macroscopic examination revealed positive findings in 85% with 50% cardiac findings. Positive cardiac findings further increased up to 63%at the end of the microscopic examination, where 3 cases of myocarditis and 4 cases of recent myocardial infarctions were added to the group. Furthermore, microscopy revealed or confirmed the cause of death in 52% of the

cases. The cause of death was revealed only after microscopy in 13%. At the end of the external and internal examination a cause of death was found in 76% while it increased to 89% at the end of the microscopy. Coronary artery disease was observed in 31% cases and a recent myocardial infarction was observed in 9%. Myocardial fibrosis with no recent infarction was noted in 11%. Myocarditis was diagnosed 6%. Atherosclerotic coronary artery disease accounts for the large majority of cases of sudden natural deaths in older people (over 40 years of age)[1]. The most frequent structural cardiac diseases in the young population reported are premature coronary artery disease, myocarditis, left ventricular hypertrophy and hypertrophic cardiomyopathy respectively[25,26].

Although, there were 63% cardiac findings there were only 41% cases of sudden cardiac death while there were 48% deaths due to non cardiac causes. This is due to presence of other morphological abnormality accounting for death in a person with a cardiac pathology. However, the main cause responsible for the sudden natural deaths was cardiac pathology. This highlights the importance of methodical autopsy with microscopy in all sudden natural deaths of young. However, this study revealed that microscopy had been done only in 63% of the cases in this group which needs further attention. This can prevent detection of cardiac causes of death which is extremely important in planning the screening process of the family members.

11% had no morphological cause of death. Autopsy of sudden unexpected death is sometimes inconclusive even after microscopy and molecular biology may have played a crucial role in coming to a conclusion [27]. Thus, it is high time for us to pay attention to molecular autopsy. This will reduce the number of cases ending up as “cause of death unascertained”.

Conclusions:

Predominantly male victims of 36-40 years are the risk group for sudden natural deaths. Cardiac causes account for majority of sudden natural deaths of young adults with coronary artery disease placed first. Systematic forensic autopsy with proper ancillary testing is essential in sudden natural deaths of young. There is a significant proportion of cases with an unascertained cause of death highlighting the importance of further studies.

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Contribution of authors

Design to the study - IDGK, PASE,
Analysis of the data- IDGK
Interpretation of the results- IDGK
Writing the manuscript -IDGK
Revising the manuscript-IDGK, PASE