A Retrospective study of Sudden Death cases in Medical College and Hospital, Kolkata

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Abstract:
Context: *To identify various causes, risk factors, age and sex distribution associated with sudden and unexpected natural deaths (SUNDs) in adults of aged above 18 years.*
Materials and Methods: *Retrospective, cross sectional analysis of autopsy reports, inquest reports and medical records of all SUNDs that occurred instantaneously or within 24 hours of onset of symptoms from July 2013 to July 2014.*
Result: *Of the total 192 deaths autopsied during the study period, 37.5% SUNDs were in age group between 41 to 60 years and chiefly in males (91.7%). There were 100 males (56.8%) and 13 females (81.25%) belonged to the age group between 41-60 years. It was observed that non cardiac causes slightly predominated (50.1%) over cardiac causes (50.0%). Non-cardiac causes included central nervous system diseases (4.2%), gastrointestinal diseases (4.2%) and respiratory system diseases (41.7%). But considering single most important system responsible for SUNDs then CVS is still predominant (50.0% alone) among all the other causes in adults over 40 years of age and chiefly was due to coronary artery atherosclerosis (41.7%).*
Conclusion: *SUND in majority of the cases is preventable. A meticulous postmortem examination along with histopathological study and detailed toxicological analysis can pinpoint the actual cause of death.*
Keywords: *Sudden, unexpected, natural, death, autopsy*

I. Introduction

As per WHO-Death is said to be sudden and unexpected when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness. But some authors limit sudden death as those occurring instantaneously or within one hour of onset of symptoms. Simply sudden death is defined as sudden or unexpected termination of life of apparently healthy individual from natural cause. It should be remembered that Natural death means that the death was caused entirely by the disease, and trauma or poison did not play any part in bringing it about.

It is worthy to mention that emphasis is given on the unexpected character, rather than suddenness of death. In many occasions the individual may not die immediately but fight for few hours after the onset of terminal symptoms. Sometimes sudden deaths occur in older individual and generally under circumstances which arouse no suspicion. But such deaths in younger individuals are likely to educe suspicion. An autopsy is highly indicated in persons covered by an Insurance policy in such a situation. A Medical Officer should not issue death certificate in cases of sudden death without autopsy and so far its suddenness is expected, the doctor should report such case to the legal authorities for necessary investigation. (1)

Sudden death often results from 1) diseases which gradually affect a vital organ without arising any noticeable symptoms until death like Coronary artery disease, 2) fatal bleeding from an Aortic aneurysm or aneurysm of cerebral arteries following a sudden rupture of a diseased blood vessel causing sudden death 3) fulminating infectious disease without any recognizable symptoms like Lobar pneumonia, bacterial endocarditis etc. and 4) Or in cases of Volvulus, strangulated hernia, twisted ovarian cysts etc due to a shift in the position of viscus.

The incidence of Sudden death is approximately 10 percent of all deaths. Where diseases of Cardiovascular system account for about 45-50%, diseases of Respiratory system 15-23%, diseases of Nervous system 10-18%, diseases of Alimentary system 6-8%, diseases of Genito-urinary system 3-5% and 5-10% are of miscellaneous causes. (2)

II. Literature survey

It is very arduous to make a comparison of the incidence of sudden death in various parts of the world because it widely varies in the prevalence of various diseases in different countries, environmental, socio economic and genetic factors. Apart from this, the range observed in the various reported incidence of sudden death in different studies may be due to various definitions of sudden death, inclusion criteria, exclusion criteria and age groups selected for the respective study.

' Incidence, causes, and survival trends from cardiovascular-related sudden cardiac arrest in children and young adults 0 to 35 years of age: a 30-year review'-conducted by Meyer L, Stubbs B et al shows that major cause of death was coronary artery disease (42.9%) in those among 25 to 35 years of age group. (3)

In the US, current statistics indicate that 80% of SCD cases are secondary to CAD, where as 10%–15% secondary to cardiomyopathy (dilated or hypertrophic) and only 5%–10% show no structural abnormality (4). However from careful post-mortem investigation, a slightly different picture manifested. Data from forensic medical examiners in the US (2348 total cases with 1891 fully characterized as sudden death cases) indicates that 57% of SCD deaths are secondary to severe CAD, 38% are secondary to non-coronary cardiac disease, and approximately 5% occurred with morphologically normal hearts.

Similar to the data presented by Morentin (5) et al. 75% of all deaths secondary to non-coronary cardiac disease (like cardiomyopathy, coronary anomalies, congenital disease, and mild to moderate atherosclerosis) occurred in persons under the age of 50, and it constituted 29% of total SCD cases. In fact 51% of the total non CAD cases occurred in males 49 years of age or younger (or 20% of the total SCD cases).

A recent study of SCD cases from a database of 1647 hearts in England conducted by Hill and Sheppard highlights the importance of autopsy studies in their observations concerning non-atherosclerotic CAD in SCD. In particular, they found that non-atherosclerotic disease was most prevalent in young males (6).

III. Problems related to sudden death

Establishing the cause of death in a case of Sudden death is really a matter of challenge for an Autopsy Surgeon because the very purpose of Medicolegal Autopsy in sudden death cases is to determine whether violence or poisoning has been in anyway responsible for the death. It has to be remembered that absence of external signs of injury does not rule out death from violence. The age of the deceased, reliable information regarding past health, illness and above all the presence of witnes at the onset of terminal symptoms is very much needed in deciding the real necessity for an autopsy. In most of the cases due to celerity of events necessary emergency investigations like ECG, chest X-ray, etc. had not been performed. And above all due to lack of reliable witness or close relatives, in many cases, detailed clinical history could not be retrieved.

IV. Aims & Objectives

1. To find the socio-demographic profile (age, sex, occupation, religion, educational level) of the deceased of sudden death.
2. History of Substance abuse from Inquest report and history furnished by relatives of the deceased.
3. Any prior history of illness as well as known family history as reported by the family members of the deceased.
4. Ascertaining the CVS, Respiratory and CNS findings from the Post Mortem report.
5. To find out the actual cause of death that revealed after Post Mortem Examination.

V. Methodology

A) Study area:
Kolkata Police Morgue, Medical College and Hospital, Kolkata.
B) Study population:
i) Inclusion criteria:
- Age more than 18 years.
- Brought dead cases (who died at home and cause of death remained undiagnosed).
- Patients who were initially admitted in Medicine/Surgery casualty ward and then died within 24 hours of admission there **with no history of injury, poisoning and terminal or chronic illness.**

ii) Exclusion Criteria:
- Age less than 18 years.
- Patients who were initially admitted in Medicine/Surgery casualty ward and then died within 24 hours of admission there **with** history of injury, poisoning and terminal illness.
- Deaths after 24 hours of the onset of symptoms.

- Cases with known congenital heart disease, chronic renal failure, chronic obstructive pulmonary disease, chronic hepatic disease or malignancy, pregnancy related deaths.

C) Study duration and period:
One year (July 2013 to July 2014).

D) Sample size and Sampling design:
All the cases which were stamped as 'Sudden Death Cases' sent for Post Mortem examination in Kolkata Police Morgue from Medical College and Hospital, Kolkata during the study period of one year has been included in this study. We found 192 numbers of such cases while going through the records. The study is a retrospective, cross-sectional study and the data for every case were taken from Post mortem Report, Inquest report and Hospital Records.

E) Study tools and techniques:
Here 192 cases which were stamped as Sudden Death cases are considered as case materials with available Inquest reports and necessary history furnished by the relatives of the deceased (mentioned in hospital records) were taken into consideration for the study. A complete autopsy was performed. Detailed gross examination findings of all the organs were noted.
Total data collected during this study period has been analyzed at the end of the study using suitable statistical tools**.**
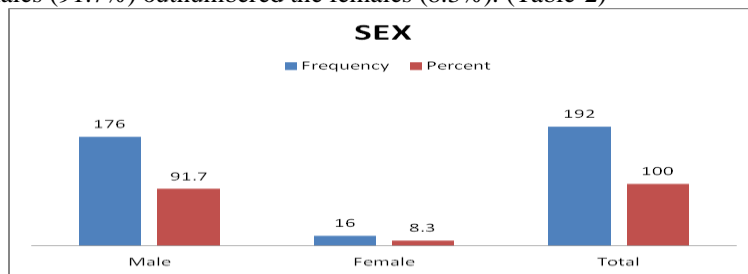
VI.   Results

1.   Distribution of study population by Age groups:
In this study 37.5% of study population belongs to age group between 41-60 years and 33.3% belongs to age group 21-40 years. (Table-1)
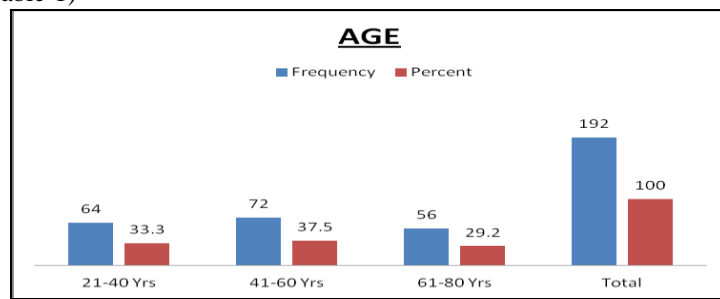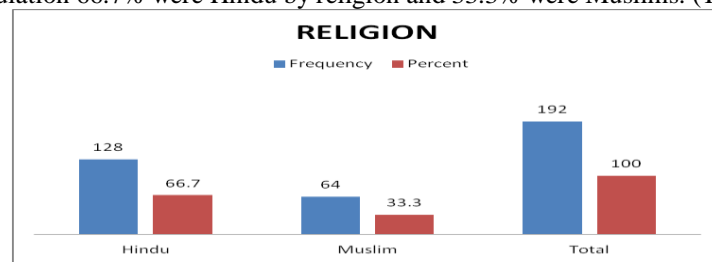

2.   Distribution of study population by Sex:
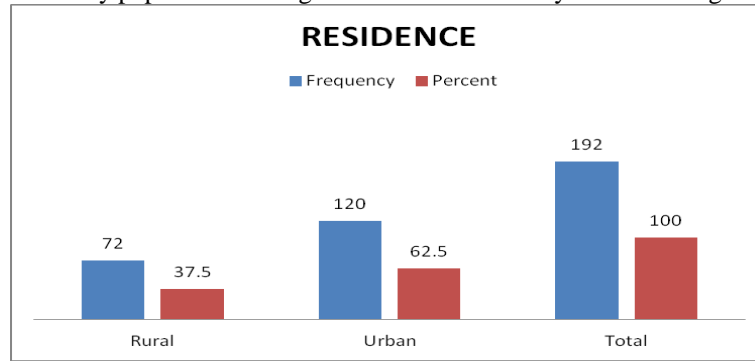Here in this study Males (91.7%) outnumbered the females (8.3%). (Table-2)

3.   Distribution of study population by Religion:
Among the study population 66.7% were Hindu by religion and 33.3% were Muslims. (Table-3)

4. Distribution of study population by Residence:
Table-4 shows 62.5% of study population belongs to urban area and only 37.5% belongs to rural area.
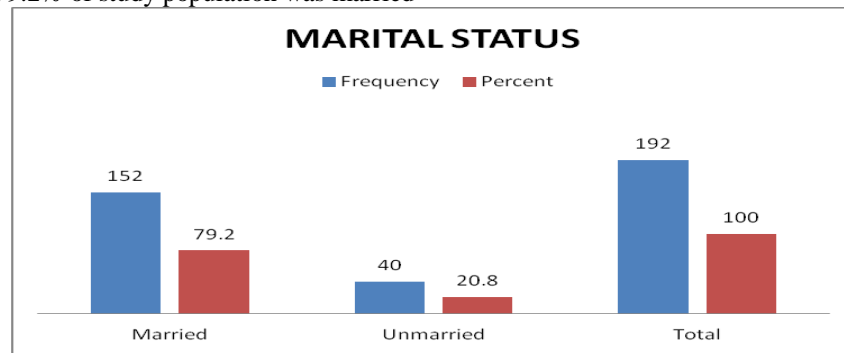

5. Distribution of study population by-Occupation:
33.3% study population was jobless, 20.8% were Businessmen, 16.7% were Labour and 12.5% were Farmer by their occupation. (Table-5)
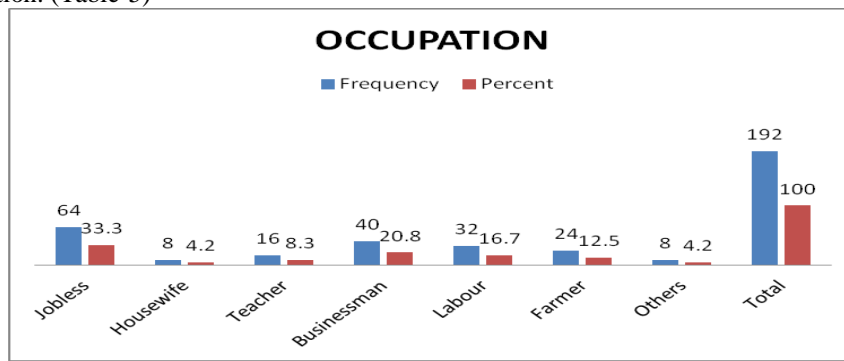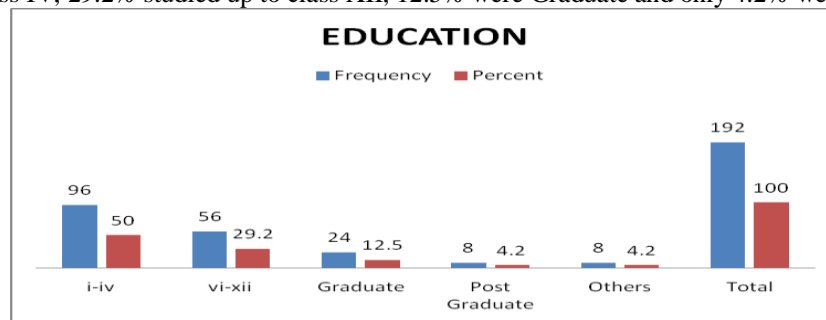

6. Distribution of study population by Marital status:
Table-6 shows 79.2% of study population was married

7. Distribution of study population by Educational level
Table-7 i.e. distribution of study population by their educational level shows 50% of study population gad studied up to class IV, 29.2% studied up to class XII, 12.5% were Graduate and only 4.2% were Post Graduate.
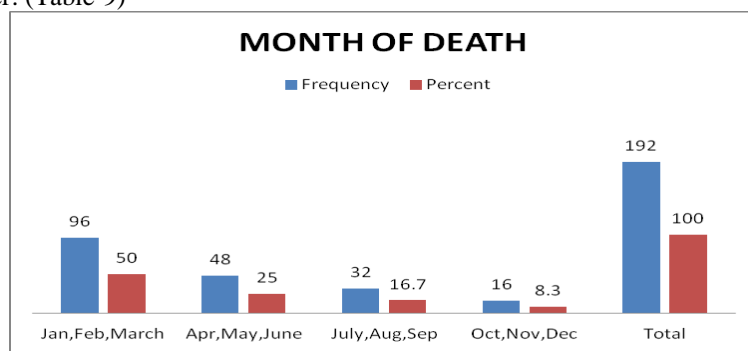
8. Distribution of study population by Place of death:

Table-8 shows that 54.2% of study population died in their home, 8.3% died in footpath and 37.5% belongs to the category Others (which includes those patients who died after being admitted in hospital).
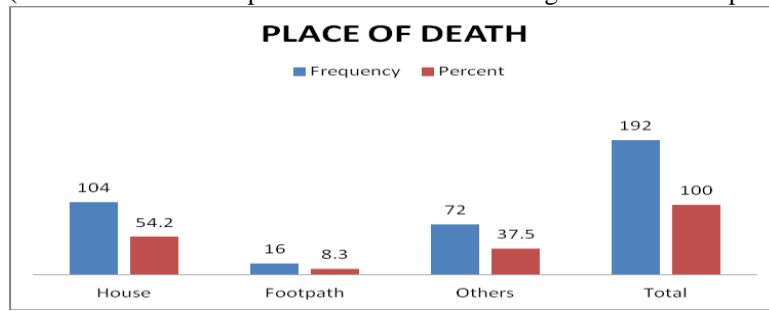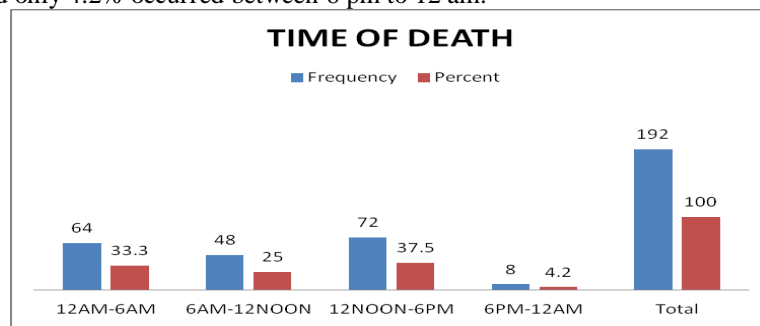

9. Distribution of study population by Month of death:

Most of the death occurred during the period between January to March (50%) and least (8.3%) occurred during October to December. (Table-9)

10. Distribution of study population by Time of death:

Table -10 reveals that most of the death occurred between 12 noon to 6 pm (37.5%), followed by between 12 am to 6 am (33.3%) and only 4.2% occurred between 6 pm to 12 am.
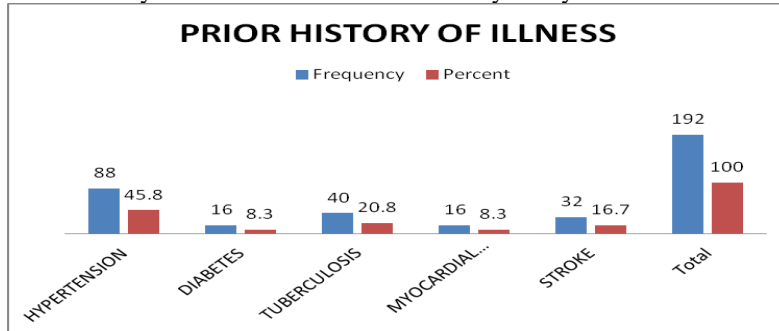

11. Distribution of study population by-Addiction:

Table- 11 shows that 54.2% study population had a history of Tobacco addiction, 29.2% were addicted to Alcohol where as 12.5 % were addicted to Ganja.
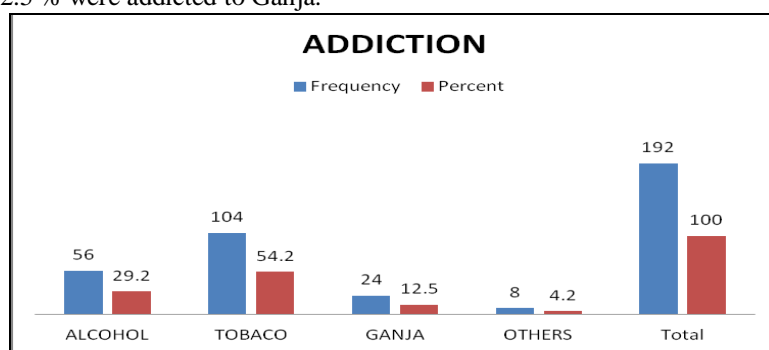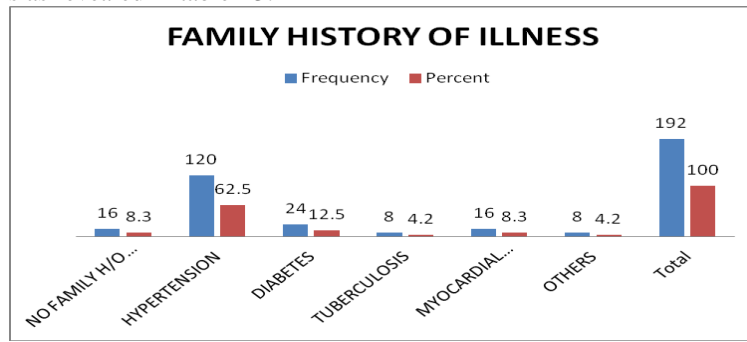
12. Distribution of study population by Prior history of illness:

45.8% of study population had a history of hypertension, 8.3% had history of diabetes, 20.8% had a history of tuberculosis, 16.7% had a history of stroke and 8.3% had a history of myocardial infarction. (Table-12)

PRIOR HISTORY OF ILLNESS

■ Frequency ■ Percent

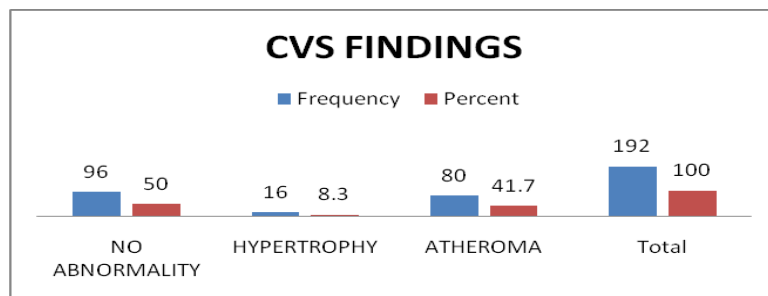|	HYPERTENSION	DIABETES	TUBERCULOSIS	MYOCARDIAL...	STROKE	Total
Frequency	88	16	40	16	32	192
Percent	45.8	8.3	20.8	8.3	16.7	100

13. Distribution of study population by Family history of illness:

62.5% of study population had a family history of hypertension, 12.5% had a family history of diabetes and 8.3% of study population had a family history of myocardial infarction, whereas only 4.2% had such family history of tuberculosis as revealed in table-13.

FAMILY HISTORY OF ILLNESS

■ Frequency ■ Percent

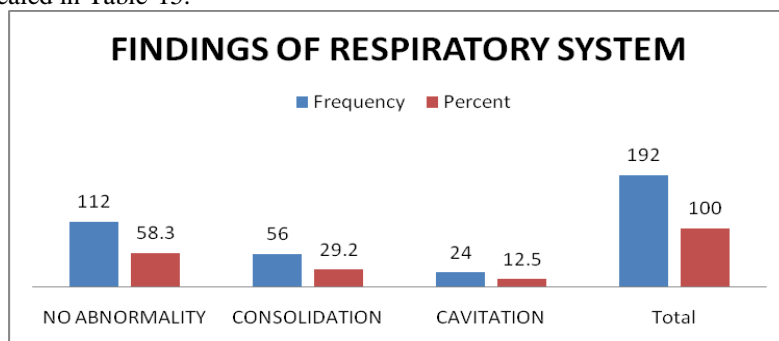|	NO FAMILY H/O..	HYPERTENSION	DIABETES	TUBERCULOSIS	MYOCARDIAL...	OTHERS	Total
Frequency	16	120	24	8	16	8	192
Percent	8.3	62.5	12.5	4.2	8.3	4.2	100

14. Distribution of study population by-CVS findings:

During Autopsy we found Coronary atherosclerosis involving one of the major branches in 41.7% cases whereas asymmetrical hypertrophy (ventricular hypertrophy with dilatation) of the heart has been found in 8.3% cases. (Table-14)

CVS FINDINGS

■ Frequency ■ Percent

	NO ABNORMALITY	HYPERTROPHY	ATHEROMA	Total
Frequency	96	16	80	192
Percent	50	8.3	41.7	100

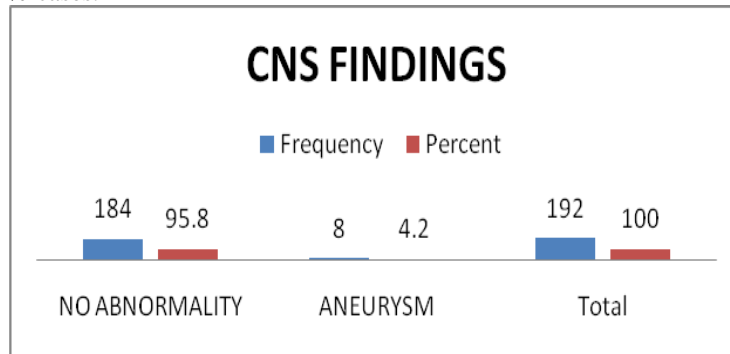## 15. Distribution of study population by Lung findings:

Consolidation of lung parenchyma detected in 29.2% cases and in 12.5 % cases there were cavitations of lung parenchyma as revealed in Table-15.

FINDINGS OF RESPIRATORY SYSTEM

■ Frequency ■ Percent

	NO ABNORMALITY	CONSOLIDATION	CAVITATION	Total
Frequency	112	56	24	192
Percent	58.3	29.2	12.5	100

16. Distribution of study population by CNS findings:
Table-16 shows subarachnoid hematoma at the base of brain detected due to ruptured Berry aneurysm in the Circle of Willis in 4.2% cases.

17. Distribution of study population by- Cause of death recorded after Post Mortem Examination:
The last table of our study i.e. Table No-17 ultimately summarizes the distribution of systemic involvement that causes 'Sudden Death' in a nutshell. It shows that 50.0% of death occurred due to involvement of cardiovascular system. Death due to respiratory causes was found in 41.7% cases and CNS was responsible only in 4.2% cases.
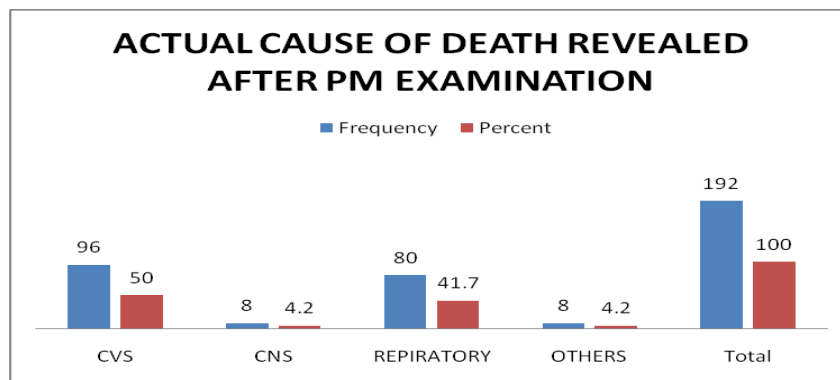
VII.   Discussion

In all these suspected natural deaths, first of all the dead bodies were examined thoroughly to exclude any sign of violence. Viscera and body fluids were sent for Chemical analysis to exclude poisoning and all these cases toxicological analysis report were negative. The total nonviolent and nontraumatic deaths that were autopsied during this one year span of in Kolkata Police Morgue were 192. Of these, total SUND in adults aged between 41-60 years of age was 72 (37.5%). Out of 176 (91.7%) males and 16 (8.3%) females, there were 100 males (56.8%) and 13 females (81.25%) belonged to the age group between 41-60 years which appeared to be the most vulnerable age group in this study. It was observed that non cardiac causes slightly predominated (4.2+41.7+4.2=50.1%) over cardiac causes (50.0%). Non-cardiac causes included central nervous system (CNS) diseases (4.2%), gastrointestinal (GI) diseases (4.2%) and respiratory system (RS) diseases (41.7%). But if we consider single most important system responsible for sudden death then CVS is still predominant (50.0% alone) among all the other causes of sudden death.

"**Sudden, unexpected and natural death in young adults of age between 18 and 35 years: A clinicopathological study"-by Madhu Chaturvedi, Meera Satoskar, Department of Pathology, LTM General Hospital and Municipal Medical College, Mumbai, India** (7) –it was observed in their study that non-cardiac causes significantly predominated (73.4%) over cardiac causes (7.8%). Non-cardiac causes included central nervous system (CNS) diseases, gastrointestinal (GI) diseases and respiratory system (RS) diseases and febrile illnesses. **But our study still reveals CVS as the major predominated cause of sudden death in adults over the age of 40 and chiefly was due to coronary artery atheroma**.

Cardiac causes-

The most common finding at postmortem examination was chronic high-grade stenosis of at least one segment of a major coronary artery. Out of 80 cases of coronary atherosclerosis and thrombosis, left anterior descending involvement was present in 72 cases and right coronary and left circumflex artery involvement were present in 6 and 2 cases respectively.. Death in these cases was thought to result from a period of transient ischemia in the myocardium which induced arrhythmia (usually a ventricular arrhythmia) which progressed

to ventricular fibrillation. As a consequence there were no gross macroscopic changes in the myocardium. Left ventricular hypertrophy was found to be the second leading cause of sudden cardiac death in the adult population in our study (8.3%). This was most commonly the result of longstanding high blood pressure (as all the patients had a history of hypertension and used to take anti hypertensive irregularly as revealed from hospital records) which has caused secondary damage to the wall of the main pumping chamber of the heart, the left ventricle.

Non Cardiac causes:
Respiratory causes: Diseases of lung here appears the 2nd most common cause of sudden death (41.7%). Similar to that of previous studies, tuberculosis and pneumonia formed the chief causes of sudden death under this category. Here in this study though 40 cases had a positive history of tuberculosis (27 cases were on Anti tubercular drugs,13 cases were defaulter),out of which 8 cases had a positive family history of the infection but cavitations were present only in 24 cases and majority of them either discontinued treatment or were recently diagnosed before death. Most of them belongs to low socio economic class and were beggar by profession. Consolidations were present in 56 cases. Majority of them are vagabonds and grossly malnourished.

CNS causes: Subarachnoid hematoma at the base of brain detected due to ruptured Berry aneurysm in the Circle of Willis in 8 cases. In majority of the cases it was diffuse and bilateral and found over orbital surface of frontal lobe and anterior third of temporal lobes. Out of these 8 cases only 2 were known hypertensive.6 out of the 8 cases died at home after a sudden onset of severe headache with vomiting and 2 died within few hours of hospital admission. Earlier studies also recorded chief cause of sudden death to CNS causes were cerebrovascular accidents. However, Bennani et al. reported sudden deaths occurred in cases of epilepsy and also in a case of meningococcal meningitis but in the present study; none of the cases had epilepsy or history suggestive of CNS infection.

Other causes: 8 cases which are marked as 'others' in this study were due to involvement of gastrointestinal system. Majority of them (7 out of 8) were due to perforative peritonitis. Autopsy revealed gastric ulcer perforation in these cases. In only one case (known to be heavy drinker) there was massive hemorrhage from ruptured oesophageal varices. The mode of death in these cases was hypovolemic shock following massive gastrointestinal hemorrhage.

VIII.   Conclusion

The above observations suggest that most of the SUNDs were due to preventable causes including infections (29.2+12.5 % cases = non tubercular + tubercular), cerebrovascular accidents (4.2%), and ischemic cardiac causes (41.7%). Involvement of CVS which still appears to be the major risk factors of sudden death was mostly due to mismanaged blood pressure level. Lack of patient awareness, timely seeking health care services and poverty still predominate the majority of deaths in our study population. Before coming to the autopsy diagnosis of sudden death, reliable history from close relatives who were present during the terminal events along with detailed clinical history from hospital records and previously available health records must be retrieved**.** A meticulous post-mortem examination along with histopathological study and detailed toxicological analysis can pinpoint the actual cause of death.

IX.   Future scopes

The incidence of sudden death is about 10% of all cases of death which is really a matter of concern for the death investigators. In a small percentage of cases, there may not be any obvious cause of death. These autopsies are called **obscure autopsies**. The cause may be endocrine dysfunctions, biochemical disturbances, viral infections etc. which will not always provide positive autopsy findings. In such cases tissues for histopathological examination along with blood for biochemical, hematological and microbiological examinations are highly required. Though in our one year study period we have not encountered any such cases where cause of death was dependent on such supportive investigations except toxicological analysis, but we are interested to expand our study period from one year to last ten years, so that it could provide a better ideation regarding the cause in SUNDs cases over the decade, as well as any major change in socio demographic profiles (specially in age and sex distribution) and risk factors. We also like to review the sudden death cases where after initial autopsy it was stamped as a case of 'obscure autopsy' and actual cause revealed after histopathological examination, toxicological analysis and other supportive laboratory investigations until and otherwise it was declared a case of 'Negative autopsy' which is still 2-5% of all autopsies.

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Fig.1. Myocardial Infarction On Anterior Wall Of Heart

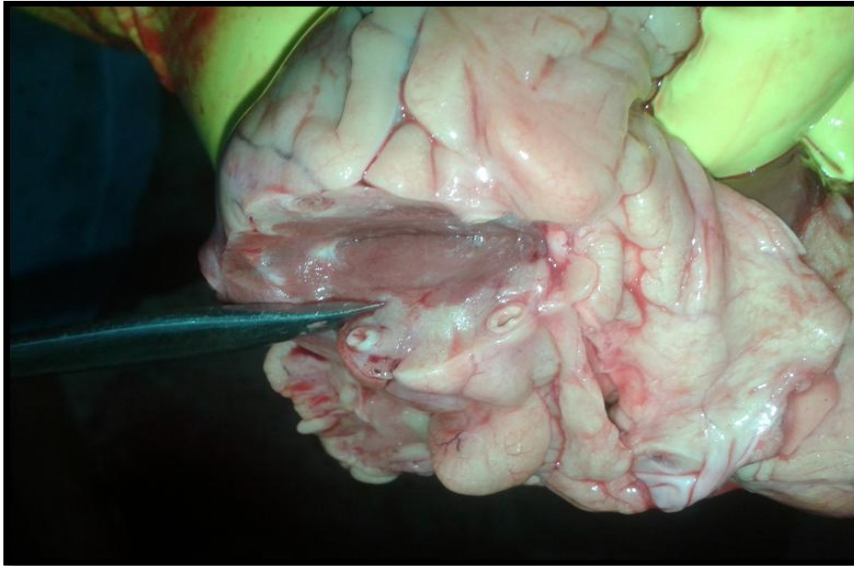**Fig 2.** Ventricular Wall Thickening Along With Vulve Cusps Calcification

Fig 3. Atheromatous Changes On Cut Section Of Heart