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Original article

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Central Nervous System Related Causes of Sudden Death: A Retrospective Postmortem Study

Rastogi Prateek*, Verma Ashutosh Kumar**

Abstract

Background: The objective of medico-legal autopsies in sudden and natural deaths is to rule out the possibility of any unnatural element of death in otherwise normal individual. The aim of the present study was to study CNS related causes of sudden death. **Materials & Method:** This autopsy based retrospective research was conducted at Kasturba Medical College, Mangalore from the cases autopsied at District Wenlock Hospital, Mangalore from 2004 to 2008. **Results:** Out of 2515 autopsies conducted during the study period 274(10.89%) were of sudden death, of which 29(10.58%) were due to CNS related diseases. Out of which 86.21% were male and 13.79% were female. In our study, rupture of aneurysm leading to the subarachnoid hemorrhage was found to be the main cause of CNS related sudden death. The most common age group in which most of the CNS related sudden deaths (62%) occurred was found out to be 40-60 years. **Conclusion:** This study emphasizes need to create awareness among people about health and regular medical checkup, especially after 40 years of age.

Key Words: Sudden death; Central Nervous System; Autopsy.

Introduction

Forensic pathologists deal not only with unnatural deaths, but also with a wide range of natural deaths, especially, if they have occurred suddenly in apparently healthy individuals [1]. Suspicion usually arises when an individual is found dead in a public place, without anyone having witnessed it [2]. Death is said to be sudden or 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 (WHO) [3]. The incidence is approximately 10 percent of all deaths [3].The purpose of medico legal autopsy in such deaths is to determine whether poisoning or violence has been in any way responsible for the death. Absence of external evidence of injuries does not preclude death from physical violence.

Disease of any body system can result in sudden death. Diseases of central nervous system account for about 20% of sudden death. Vascular injury is a frequent component of CNS trauma and results from direct trauma and disruption of the vessel wall. Depending on the anatomic position of the ruptured vessel, hemorrhage will occur in any of several compartments (sometimes in combination): epidural, subdural, subarachnoid, and intraparenchymal.

Hemorrhages within the epidural or subdural space are typically related to trauma. Hemorrhage within the brainparenchyma and subarachnoid space, in contrast, are often a manifestation of underlying cerebrovascular

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disease, although trauma may also cause hemorrhage in these sites.

Most frequent cause of subarachnoid hemorrhage is rupture of a saccular (berry) aneurysm. Rupture of an aneurysm with clinically significant subarachnoid hemorrhage is most frequent in the fifth decade [4]. Hypertension is the most common cause of primary parenchymal (intracerebral) hemorrhage, accounting formore than 50% of clinically significant hemorrhage [4]. The aim of the present study is to study of CNS related causes of sudden death.

Materials and Methods

This autopsy based retrospective research was conducted at Kasturba Medical College, Mangalore from the cases autopsied at District Government Hospital, Mangalore from 2004 to 2008. Autopsies of persons found dead or who died within 24 hrs after onset of terminal illness and having no history of any injury, poisoning or previous disease, were selected as cases of sudden death.During this period total 2515 autopsies were conducted, out of these 274(10.89%) were of sudden death. After the data had been collected, it was entered manually into Microsoft Office Excel Worksheet and analysed.

Results

During the period of 5 years, the total 2515 autopsies were conducted, out of which 274 cases were of sudden death. Among these 274 cases of sudden death 29(10.58%) cases were due to CNS related diseases of which 29 cases 25 (86.2%) were male and 4 (13.79%) were female.

According to our study (Figure -1), the most common age group in which most of the CNS related sudden deaths (18) occurred was found out to be 40-60 years. In 20-40 years of age group there were 10 cases. In the extreme age group, above 70 years old, only 1 case was recorded.

Figure 2 shows the total number of death caused by CNS diseases in last 5 years (2004-2008). The year 2007 had the least number of CNS death cases. It comprised only 3 cases. The highest CNS death rate was recorded in the year 2006 (8 cases). In rest of the year same number of CNS death cases (6) was recorded.

Fig 1: Total number of CNS related death according to age group

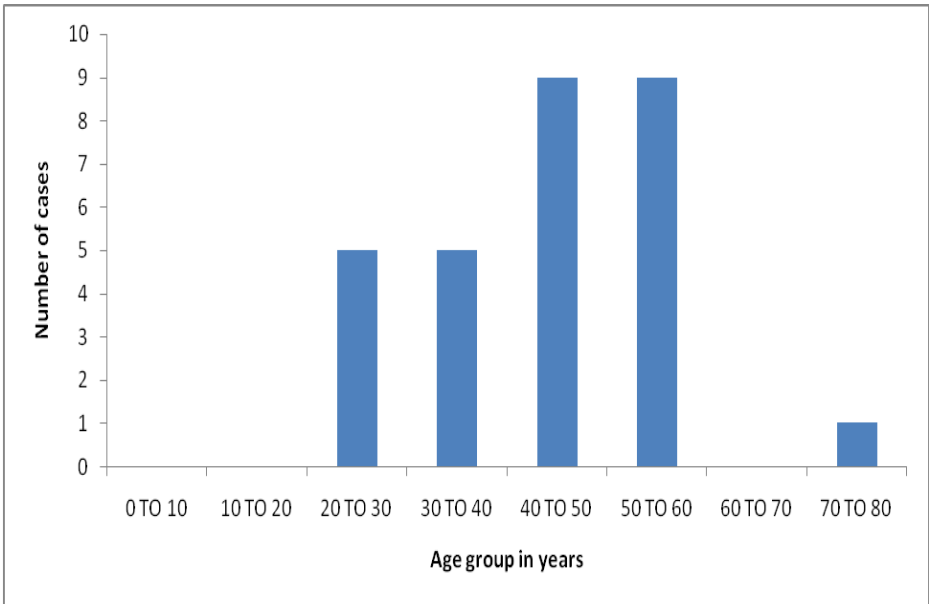

Fig 2: Total number of death caused by CNS diseases with its association with both the sex

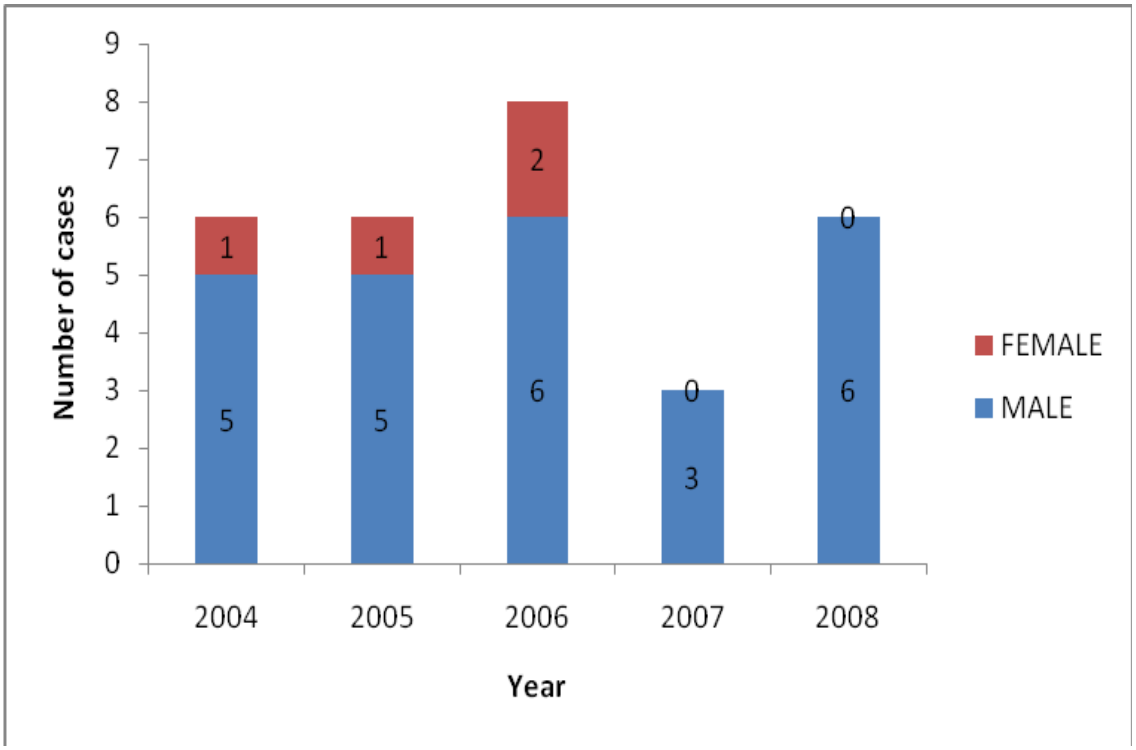

Fig 3: The association of Body Mass Index (BMI) with death due to CNS related diseases

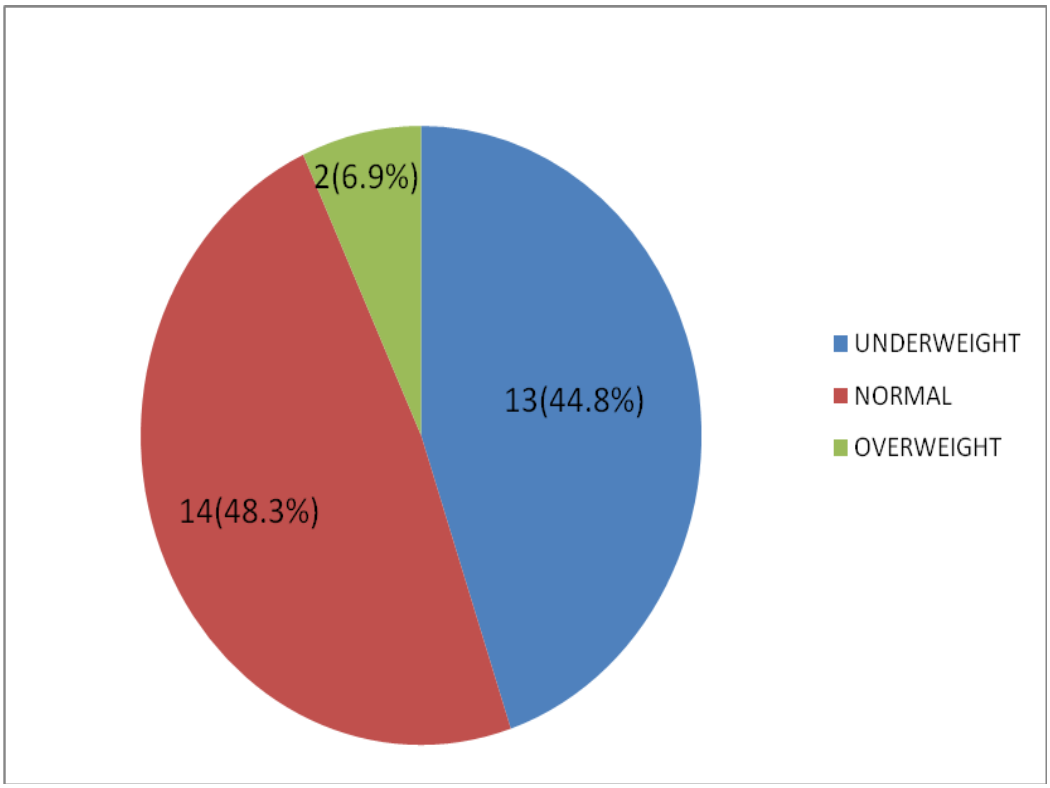

Fig 4: Cause of Death

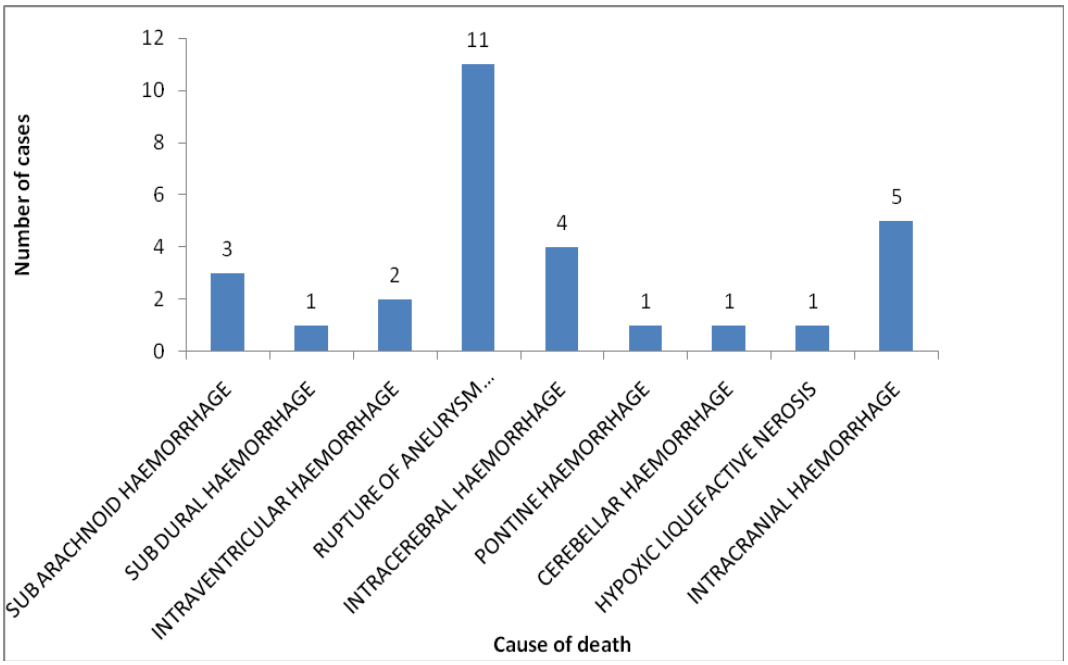

Figure 3, shows the association of body mass index (BMI) with death due to CNS related diseases. 13(44.8%) of those died of CNS diseases were underweight with BMI less than 18.5. 14(48.3%) of people with normal BMI (18.5-23.0) died of CNS diseases. Only 2(6.9%) were overweight (23.0- 30.0).

Rupture of aneurysm leading to the subarachnoid hemorrhage was found to be the main cause of CNS related sudden death. Subarachnoid hemorrhage was found in 13 cases. Intracerebral hemorrhage was found to be the second major cause of death comprising of 7 cases (Figure 4).

Discussion

Out of 2515 autopsies conducted during the study period 10.84% were sudden death among which CNS related causes accounted for 10.58%. In a study on sudden death done by Pande A.K.et. al. [5] death due to pathology in CNS accounted for (13.59%) while it was 4.3% in another study done by Thomas A et. al.(1988) [6]. This suggests that CNS is an important contributor to sudden death cases. In the study, Male: Female ratio was 6.25: 1 thus showing a clear male predominance.

Sixty two pecent deaths occurred in age group of 40-60 which points out the preponderance of this age group for CNS related sudden death fatalities. Fatalities were equally distributed in underweight as well as among people with normal BMI, while unlike CVS related suddeen death cases overwight people appears to be less affected.

In most of cases, rupture of aneurysm leading to the subarachnoid hemorrhage was found to be the main cause of CNS related sudden death followed by subarachnoid hemorrhage and intracerebral hemorrhage. In a study on sudden death, done by Pande A.K. et.al.[5], 31 CNS cases (13.59%) were reported and out of these 31 cases 17 cases (54.8%) were due to subarachnoid and intracerebral hemorrhage.

Conclusion

1. Sudden natural death occured more commonly in males with male-female ratio as 6.25:1.

2. Frequency was higher between 40-60 years.
3. Subarachnoid hemorrhage (44.8%) was found to be the leading cause of CNS related sudden deaths.
4. Sudden death due to CNS related diseases were more in underweight people than overweight people.
5. Hypertension is a major cause of intracranial hemorrhage so there is need to create awareness among people about health and regular medical checkup, especially after 40 years of age.

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Original article

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Comparative Evaluation of Clinical and Autopsy Findings in Head Injury Cases

Srinivasa Reddy P *, Manjunatha B**

Abstract

Background: Head injury is the commonest phenomenon on road resulting from high velocity automobiles and these injuries account for about one fourth of all deaths due to violence and are responsible for 60% of fatal road accidents. The application of computed tomography to the early diagnosis of head injured patient offered great promise. So this study is aimed to compare the CT (Head) scan with autopsy findings in head injury cases.

Material & Methods: Post-mortem examination was conducted in 65 fatal cases of head trauma, which were admitted and died while on treatment in the department of neurosurgery at JSS hospital Mysore.

Results: In the present study CT scan and autopsy would detect skull fractures 44%, intracranial hemorrhages 76% and brain lesions 95% of cases.

Conclusion: This study showed that CT scan is a very useful investigation in head injury cases to detect brain lesions, intracranial hemorrhages and to some extent skull fractures.

Keywords: Autopsy; C T scan; Head injury.

Introduction

Head injuries are a very common cause of deaths all over the world. As a part of routine clinical investigations, now a day's C T scan is done in most of the cases of head injuries. The application of C T scan to the early diagnosis of head injury is of great value. The patients who do not survive are subjected to further investigation in the form of autopsy examination. In most of the cases a comparison can be established between the reported C T scan findings and autopsy findings [1].

Aim & Objectives

1. To compare C T scan (Head) with autopsy findings in head injury cases.

2. To identify the lesions caused by head injuries, this may be misdiagnosed or may remain undiagnosed by C T scan and can be diagnosed by post mortem examination and vice versa.

Methodology

The present study was retrospective and prospective study of 65 fatal cases of head trauma (admitted to Neurosurgery department of J.S.S. Medical College and Hospital Mysore. who died while on treatment) on whom post-mortem examination was performed in the Department of Forensic Medicine, J.S.S.Medical College. The cases, which were admitted to the hospital, but died before any investigations and those associated with any medical illness would be excluded from the study. The information was obtained from in-

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patient case sheets of J.S.S. Medical College and Hospital and postmortem reports in the department of Forensic Medicine. A detailed history pertaining to time, manner, and manifestations of head injury and investigations such as C T scan (Head) findings were recorded in the proforma. Details of injuries to skull and its contents as noted during postmortem examination were also recorded.

Table 1: Skull fractures: Comparison between CT scan and autopsy findings

Sl. No	Comparison	No. of Cases (No.= 65)
1.	C T and autopsy findings concurred	25
2.	Findings only at autopsy	31
3.	No findings	9

Table 2: Meningeal haemorrhages: Showing comparison of CT scan and autopsy findings

Sl. No	Comparison	No. of Cases (No.=65)
1.	C T and autopsy findings concurred	47
2.	Findings only at autopsy	15
3.	No findings	3

Table 3: Brain lesions: showing comparison between CT scan and autopsy findings

SL. No	Comparison	No. of cases (No = 65)
1.	C T scan & autopsy findings concurred	57
2.	Findings only at autopsy	3
3.	No findings	5

Results

Comparison of CT scan and autopsy findings in skull fractures were depicted in Table No1. Both CT scan and autopsy findings concurred in skull fractures in 25 cases, but only autopsy detected skull fractures in 31 cases. So skull fractures can be better picked up by autopsy rather than CT scan.

Table No 2 showed the comparison between CT scan and autopsy findings in intracranial hemorrhages. Here both CT scan and autopsy findings concurred in intracranial hemorrhages in 47 cases, but findings only autopsy is 15 cases. This shows that CT scan and autopsy were better tools to detect intracranial hemorrhages than autopsy alone.

Table No 3 showed the comparison between CT scan and autopsy findings in brain lesions. Both autopsy and CT scan would detect brain lesions in 57 cases and autopsy can detect only in 3 cases. So brain lesions are better detected by CT scan and autopsy rather than autopsy alone.

Discussion

In the present study, there is a concurrence of C T scan & autopsy findings among 44% of cases with respect to skull fractures were noted.

According to R Sharma & A Murari, comparative evaluation of C T scan & autopsy findings in 50 head injury cases, he observed that 76.3% of them were diagnosed in both C T scan & autopsy, where as 23.7% of them remained undiagnosed by C T scan in respect to skull fractures [1]. But in our study skull fractures (majority fissured fractures) are better detected by autopsy rather than CT scan.

Goyal M. et al (2003) studied 140 cases of head trauma those had been treated in the department of Neurosurgery. X – Ray skull gives better information on the fractures of the skull than the C T scan. When the fractures of the skull is depressed variety, or had a depressed component of with the linear fracture

of the vault of the skull, the C T scan can detect the displaced tables of the skull bones. The C T scan could not detect the fractures of the top of the vault of the skull as well as the fractures of the base of the skull particularly the fractures of middle and posterior cranial fossa [2].

Fractures are, in most instances, best diagnosed by a combination of clinical features and radiodiagnosis. However, the chief value of the C T scan is in the assessment of underlying brain damage and haematoma formation [3].

In present study both C T scan & autopsy findings were concurred in 76% of cases with respect to meningeal haemorrhages which is in accordance with the Akang EEU (2000) who studied in 529 fatal head injury cases [4]. In his study, radiological investigations were carried out only in 11.3% of cases but CT scan was done only in 50% of the patients that had radiological studies. Interestingly, among 50% of the patients the intracranial hemorrhages was the most common finding (36%). Therefore he concluded that CT scan is an essential investigation which should be available for all cases of head injury. The documentation and localization of intracranial hemorrhages guides neurological intervention and critical management of these patients.

In the present study, there is concurrence of CT scan & autopsy findings in 95% of cases with respect to brain lesions. Our study is in accordance with A Murari & R Sharma who observed that 82% of cases diagnosed both by CT scan and autopsy findings with respect to brain lesions. Federal et al also showed that there is 100% accuracy in diagnosis of extra and intra cerebral collection of blood [5]. So according to this study CT scan can be used as a tool to detect the brain lesions in head injury cases.

Conclusion

In this study C T scan could detect 44% of skull fractures. But in case of intracranial haemorrhages & brain lesions the C T scan could detect up to 75% & 95% cases respectively. This suggests that C T scan is very useful investigation in head injury cases to detect the brain lesions, intracranial haemorrhages & to some extent skull fractures. Autopsy being a direct visual examination of the lesions can detect more pathological findings compared to C T scan, which is essentially an interpretation of images. C T scan if done early can guide the treating doctors in the management of patients.

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Original article

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Postmortem Prolactin Level may be an Indicator of Antemortem Stress: A Pilot Study

Manisha Singh*, Tanuj Kanchan**

Abstract

Objective: To estimate postmortem prolactin levels in cases of completed suicides and find if the postmortem prolactin levels are raised and associated with antemortem stress in completed suicides.

Material and Methods: The present research was conducted in the Department of Forensic Medicine, Kasturba Medical College, Mangalore during May and July 2010. Postmortem blood samples were collected from the right femoral vein of male victims of suicide before the start of the autopsy and in vitro quantitative analysis of non-hemolysed blood sample was done using the principle of electrochemiluminence.

Results: Most of the victims of suicide were aged between 30 and 49 years and hanging was the commonest method of suicide. Mean postmortem serum prolactin level was found to be marginally higher in suicidal deaths suggestive of a possible association of serum prolactin, stress and suicides.

Conclusions: The prolactin levels using postmortem blood samples in completed suicides were successfully determined. Our preliminary investigation is suggestive of a possible trend and an association of postmortem serum prolactin levels with antemortem stress and completed suicides. The association however is not strong and needs to be studied further in future studies.

Keywords: Suicides; Antemortem stress; Prolactin; Postmortem.

Introduction

Stress is inevitable in today's life. A relation between psychological stress and deliberate self-harm is well established. Every year over one million people commit suicide and around 10 to 20 million non-fatal attempted suicides are reported worldwide. The World Health Organization estimates completed suicides as the thirteenth-leading cause of death worldwide. [1]. According to National Crime Records Bureau (NCRB) report for the year 2006, over one lakh suicidal deaths occur in India every year. India alone contributes to more than 10% of suicides in the world. The suicide rate in India has been increasing steadily and has reached 10.5 (per 100,000 of population) in 2006 registering a 67% increase over the rate reported in 1980. Psychiatric, biological, social and environmental factors place individuals at increased risk for suicide. Considering the subjectivity and complexity of human nature and individual reality, a logical explanation on causes of suicides needs a comprehensive analysis of views based on sociology, pathology, psychology, and biochemistry taken together. Neuro-endocrine alterations in a human body are one of the aspects of stress, which can set in pathophysiological sequence of changes [2]. It is difficult to avoid stress but we can prevent suicides as the results of stress, by the early diagnosis of signs and symptoms of suicides and specific intervention [3].

Prolactin is a hormone secreted by lactotrope cells situated in anterior pituitary gland. It is mainly responsible for lactation, sexual arousal, myelination of neurons,

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surfactant synthesis in fetal lungs in humans and is thought to play a significant role in human stress response. Previous studies have indicated an association between psychological stress and hyperprolactinaemia [4-8]. Though the relationship between stress and hyperprolactinaemia is known in the living, no study has established if a similar relation exists between antemortem stress and postmortem prolactin in cases of confirmed suicides. Scientific literature on the estimation of plasma prolactin level at autopsy is restricted to a study by Jones and Hallworth on the relation of antemortem physical stress in various causes of death including cases of fatal self-harm [7]. The present research studies the postmortem plasma prolactin levels in completed suicides and tests the hypothesis that postmortem hyperprolactinemia is related to antemortem stress. This preliminary investigation is done to find out the association between postmortem serum prolactin levels with suicidal behavior and find if postmortem prolactin levels are raised in completed suicides.

Material and Methods

Study Setting

The study was conducted in the Department of Forensic Medicine, Kasturba Medical College, Mangalore (Affiliated to Manipal University).

Study design

A prospective autopsy based study for the biochemical estimation of serum prolactin in postmortem blood samples in completed suicides to find if postmortem prolactin levels are raised in completed suicides.

Study subjects

Suicidal death among males autopsied at the Government District Wenlock Hospital mortuary in Mangalore during the study period (May and July 2010).

Methodology

An approval was taken from the Institutional ethical committee prior to conducting the study. Informed consent was obtained from the legal heirs of the victims before undertaking the research. Personal information along with the details of past clinical and drug history of the victims of suicide was collected from the relatives and hospital records if any. Autopsy findings and the information furnished by the investigating police officer into the cause and manner of death was recorded. All the information was put in a proforma. Postmortem blood samples were collected from the right femoral vein in cases of suicides for estimation of serum prolactin levels. Normal range of serum prolactin in males according to the chemiluminescence technology ranges between 4.8 and 15.2 ng/ml.

Inclusion criteria

All adult male autopsy cases of suicide with a survival period of less than 12 hours and postmortem interval of less than 24 hours were included in the study.

Exclusion criteria

Cases with other associated causes of hyperprolactinemia such as known pituitary disorders, systemic disorders (e.g. chronic renal failure, hypothyroidism, cirrhosis etc.) pregnancy, lactation, and history of intake of hyperprolactinemia causing drugs (e.g. Dopamine receptor blockers, H_2 blockers, tricyclic anti-depressants, estrogens, antiandrogens, opiates).

Cases with survival period of more than 12 hours and postmortem interval of more than 24 hours were excluded from the study. Hemolysed blood samples were excluded from the analysis.

Statistical Analysis

Statistical considerations could not be effectively applied owing to the small sample size of this preliminary time bound research project.

Results

All the victims of suicide included in the study were males aged between 21 and 60 years. Mean age of the victims was 39.10 ± 10 years. Maximum victims of suicides (80%) were in the 4th and 5th decade of life. 90% of the victims were married. Hanging was the preferred method of suicide (90 %) in most of the victims included in the study. In the hanging cases, cotton cloth was the most commonly used ligature material (62.5 %), followed by nylon rope (25%) and synthetic saree material (12.5 %). It is observed that two victims committed suicide due to financial instability, one because of some chronic underlying pathology, and one of the victims was suffering from depression. In the remaining victims (n=6) the exact reason behind suicide remained unknown at the time of autopsy. Among the suicide victims, 2 victims were known alcohol addicts, 1 was suffering from depression and stayed alone in his house, and another victim had killed his lover before hanging himself.

Serum prolactin levels in cases of suicides ranged from 6.3 – 34.0 ng/ml. Mean serum prolactin level among the cases was found to be 15.7±8.3 ng/ml. A mean serum prolactin level of 14.97±8.3 ng/ml was observed in the cases of suicidal hangings. Normal range of serum prolactin in males is 4.8 – 15.2 ng/ml. The serum prolactin levels in cases of suicides were arbitrarily grouped into three categories; less than 10 ng/ml, 10 to 15 ng/ml and more than 15 ng/ml, it is observed that only 20% of the suicidal victims had serum prolactin level < 10 ng/ml, 40% had a prolactin level between 10 to 15 ng/ml and 40% had a serum prolactin levels > 15 ng/ml.

Table 1: Victim profile and postmortem prolactin levels in cases of suicide during the study period

S no.	Age	Underlying cause	Method of suicide	Survival (hours)	Prolactin level (ng/ml)
1. *	49	Undetermined	Hanging	0	16.8
2.	30	Undetermined	Hanging	0	06.3
3. #	55	Chronic disease	Hanging	0	10.4
4.	39	Undetermined	Hanging	0	34.0
5.	31	Undetermined	Hanging	0	22.0
6. #	45	Financial instability	Hanging	0	09.5
7.	40	Depression	Hanging	0	10.2
8.	21	Undetermined	Poisoning	8	22.0
9.	36	Financial instability	Hanging	0	11.0
10	45	Undetermined	Hanging	0	14.5

Information on the underlying cause was based on the information furnished by the police and relatives at the time of autopsy

* Killed his lover before hanging himself.

Chronis Alcoholic

Victim profile and postmortem prolactin levels in cases of suicides during the study period are detailed in Table 1.

Discussion

Suicide in males is more common in most countries. Relationship between gender and suicide has been extensively researched. It is reported that males die much more often by

suicide than do females, although reported suicide attempts are more common among females. Males are considered to be at a higher risk of suicides considering the stress related to work and finances. Mostly males in the society earn a livelihood for their own families, so unemployed men often see themselves as failures and burden on their families. In addition, alcohol is a more common practice among males that makes them more vulnerable to suicidal attempts [9-14]. Most of the suicide victims included in the study had committed suicide by hanging. Hanging is the prevalent means of suicide in pre-industrial societies and is more common in rural than in urban areas. Hanging is a preferred method of suicide because it results in quick death and the approach is easy. All male victims of suicides with a survival period of less than 12 hours were included in the present study. The higher number of hanging victims in the present study is owed to the inclusion criteria of survival less than 12 hours. Victims opting for less lethal methods of suicides like poisoning and burns are very likely to survive for longer durations than hanging that immediately cause death in most cases. In the present study, most of the victims of suicide were in the 30-59 year age group. A study done in India indicates that the incidence of suicides is the highest in 30-44 year-old and tends to decline in higher age categories [15]. Most of the victims in our study were married, an observation similar to that reported in India. A study done in Italy showed that suicide rate among divorced and single men are significantly higher than that of married men [16].

Relation between stress and suicides is known. Stress is a major contributing cause behind suicides. In a study done to examine the associations between self-perceived stress and death from suicide among adult women, the risk of suicide was over eightfold among women reporting high stress compared with those reporting low stress [17]. Most common reason for suicides in the study was financial instability. Poverty may not be a direct cause but it can increase the risk of suicide, as it is a major risk group for depression [11]. Socio-economic factors such as unemployment, poverty, homelessness, and discrimination may trigger suicidal thoughts [18]. Two victims of suicides in the study were alcohol addicts. In the United States 16.5% of suicides are related to alcohol [19]. Alcoholics are 5 to 20 times more likely to kill themselves while the misuse of other drugs increases the risk 10 to 20 times. Recent research has concluded that chronic excessive alcohol intake itself directly causes the development of major depressive disorder in a significant number of alcohol abusers [20]. In one case of suicide, the victim had killed his lover before restoring to hanging. One of the victims suffering from depression was staying alone in his house. An earlier study showed that middle-aged patients of deliberate self-harm who live alone appear to be particularly vulnerable to suicides [21].

Prolactin has a biological half-life of 20 minutes and remains stable in vitro for up to seven days at room temperature. Jones and Hallworth [7] in their study determined for the first time that plasma prolactin can be measured in blood taken at necropsy. Our study confirms their view on post-mortem analysis of plasma prolactin. Mean postmortem prolactin level in our study on completed suicides was marginally higher with 40% of the suicide victims showing raised post-mortem serum prolactin levels. In the only other study on the subject, Jones and Hallworth [7] studied the relation of antemortem physical stress in various causes of death including cases of fatal self-harm. They reported that prolactin was within the normal range in cases of death from trauma where death occurred very soon after the traumatic event. In sudden unexpected cardiac deaths the mean prolactin concentration was just above normal while mean prolactin in postoperative deaths and those from chronic disease was clearly raised. Some cases of suicides in their study had significantly raised values of serum prolactin. Their observations on serum prolactin in suicides were however influenced by effect of drugs. Our findings on plasma prolactin in hanging cases in the present study are similar to that observed in the hanging cases reported

by Jones and Hallworth [7] with an exception of higher levels in a hanging case where the female was on hormone replacement therapy in their study. It is presumed that suicide is the end result of unbearable stress. Relation between stress, suicides and prolactin however, is a complex multifactorial process. It may be argued that prolactin levels may not be raised in cases where suicide was an outcome of an event of acute stress. In view of the slightly higher mean plasma prolactin levels in postmortem blood samples in cases of suicides reported in the study, a possible association between postmortem serum prolactin levels with antemortem stress and completed suicides can be considered. The association however is not strong as reported in the earlier study [7].

Conclusion

The prolactin levels using postmortem blood samples in completed suicides were successfully determined. The findings of our preliminary investigation are suggestive of a possible trend and an association of postmortem serum prolactin levels with antemortem stress and completed suicides.

Limitations in the study exist with regard to a small sample size and lack of statistical analysis. Limitations regarding small sample size are primarily owed to the time bound nature of research project supported by the Indian Council of Medical Research (ICMR) and secondarily due to the robust inclusion and exclusion criterion set in the study keeping in view the possible biases of increased physical stress if person survives for some time and the possibility of postmortem degradation of prolactin, biases on gender, and even the methods employed in suicides.

Considering the limitations of the study, future research on larger samples is suggested to confirm the findings of our preliminary investigation. It is suggested to correlate serum prolactin and stress levels in psychological autopsies for a better understanding of the association and reasons behind suicides.

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Post-mortem Diagnosis of Vaso-occlusive Sickle Cell Crisis

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Abstract

A great deal of controversy continues to surround sickle cell trait and its association with stress-related morbidity and sudden death. Most of the death mechanisms are related to the biological consequences of diffuse microvascular occlusion due to sickling, although a significant number of such sudden deaths remain unexplained even after thorough autopsy. We present a case of unexpected death in a young male with undiagnosed sickle cell trait, who met with a road traffic accident and was diagnosed only after the postmortem. The death was attributed to vaso-occlusive sickle cell crisis secondary to stress and infection.

Key word: Sickle cell trait; Sudden death; Vaso-occlusive crisis.

Introduction

Sudden death in a young male is usually a cause of speculation. The cause of death could be both natural and unnatural. It is traumatizing for the family members and the situation is aggravated if past history is not available [1]. Overall evidence suggests that sickle cell trait (SCT) may be neither a completely benign carrier state nor a true disease entity, but rather a risk factor for certain adverse outcomes that result from the interplay between genetic and environmental influences. Although rare, sudden death is the most serious complication of SCT [2]. We are presenting this case of unexpected sudden death in a young male patient with undiagnosed SCT. The non-specific nature of his complaints and the paucity of clinical signs misguided the clinicians on the potentially lethal outcome.

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Case presentation

A 23- year- old male patient was brought for neurosurgical evaluation. He had a history of road traffic accident one and a half months back, for which he was treated else where. On examination, the patient had an in-situ tracheostomy tube. He was conscious, not responding to oral commands with minimal response to deep painful stimuli. There was injury to the face around the mouth and jaw. On auscultation of the chest, bilateral basal crepitations were present. Per abdominal examination revealed no organomegaly. His blood pressure was 100/58mm of Hg, pulse rate was 96/min and oxygen saturation was 92%. The electrocardiogram was normal except for sinus tachycardia. X-ray chest was normal. Only hemoglobin was done which was 9gm%. The electrolytes were normal. Urine was turbid with a trace of albumin, 10-12 pus cells/hpf and 3-4 RBCs /hpf. He was given antibiotics, antacids and IV fluids. A computerized tomography (CT) scan of the head revealed edematous brain with hemorrhagic areas in the left temporal and frontal lobes with a thin bleed in the inter-hemispheric fissure. CT thorax showed collapsed intact lungs. On CT abdomen, liver showed hemorrhagic contusion on posterior surface of the right lobe. He was given oxygen therapy and later given ventilatory support as he became breathless and the oxygen saturation dropped.

The patient's condition deteriorated, had unexpected cardio-respiratory arrest on the next day and could not be resuscitated. A medico-legal autopsy was done.

Autopsy findings

Poorly built and poorly nourished body measuring 180cm in length and was weighing 38 kilograms. Body appeared emaciated with sunken eyes, yellow sclera and prominent rib cage. Externally, multiple partially healed wounds were seen. Internal examination revealed an edematous brain with yellow brown areas in the left temporal and both frontal lobes. Lungs showed multiple tiny nodules over the surface and the cut section was grey white to grey brown. The liver was pale yellow in color with brownish black discoloration on the posterior aspect of the right lobe. The provisional diagnoses were that of tuberculosis and immunocompromised state. Random bits from liver, lungs and brain were sent for histopathological examination. On gross examination, the lungs weighed 250gms, cut section there were grey brown to grey white areas of consolidation, bit of liver tissue measured 9x6x2cm, cut section was pale yellow and brain tissue weighed 450gms and cut section showed yellow brown area measuring 4x2cm. (Figs 1A, 1B, 1C)

On histopathology, multiple sections from the lung tissue showed macrophages and blood vessels filled with sickled erythrocytes with areas of consolidation. Sections from the liver showed congested sinusoids filled with sickled erythrocytes Sections from the brain showed edema with blood vessels containing sickled erythrocytes (Figs 2A, 2B, 2C).

Fig 1A: Lung with grey brown to grey white areas of consolidation

Fig 1B: Liver appears pale yellow

Fig 1C: Cut section of brain with yellow brown area

Fig 2A: Photomicrograph showing sickled RBCs in the lung (H&E, x200)

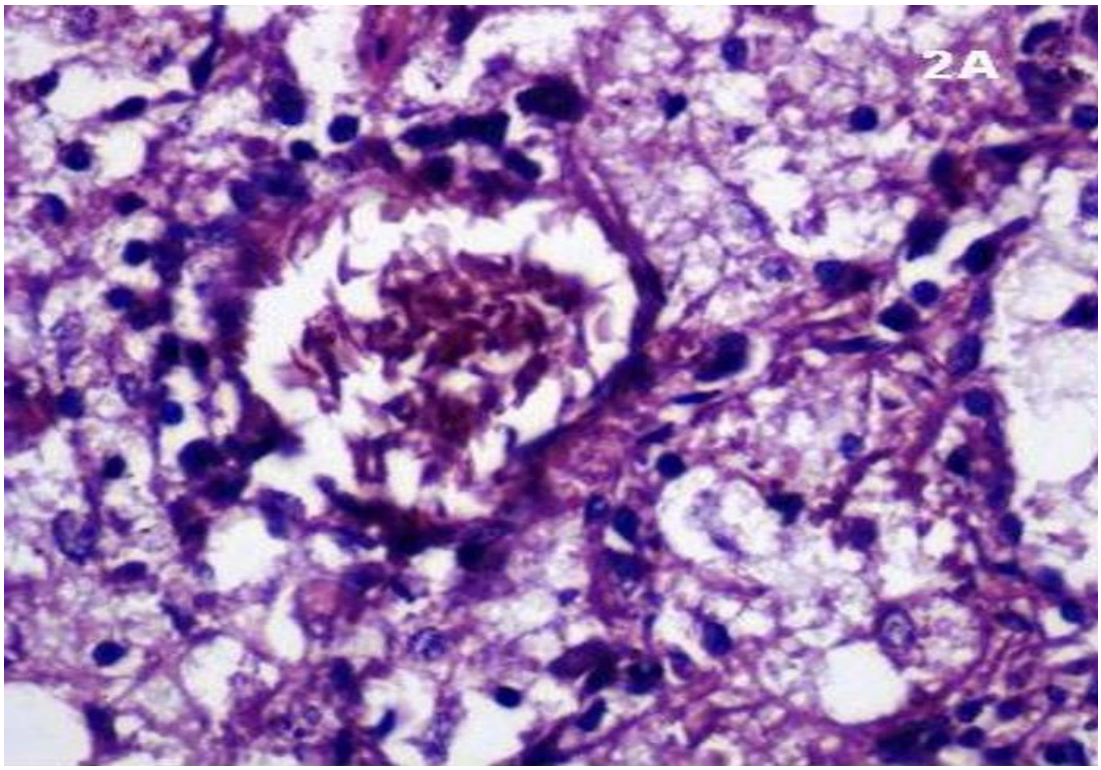


Fig 2B: Photomicrograph of liver with sickled RBCs within sinusoids (H&E, x200)

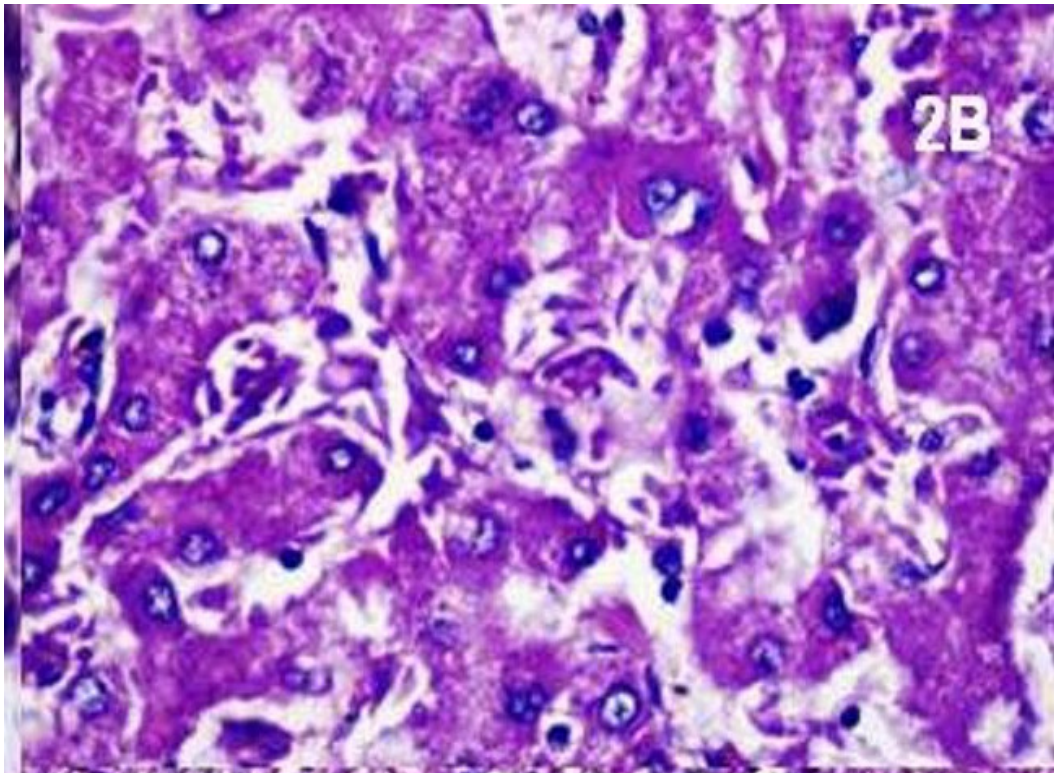
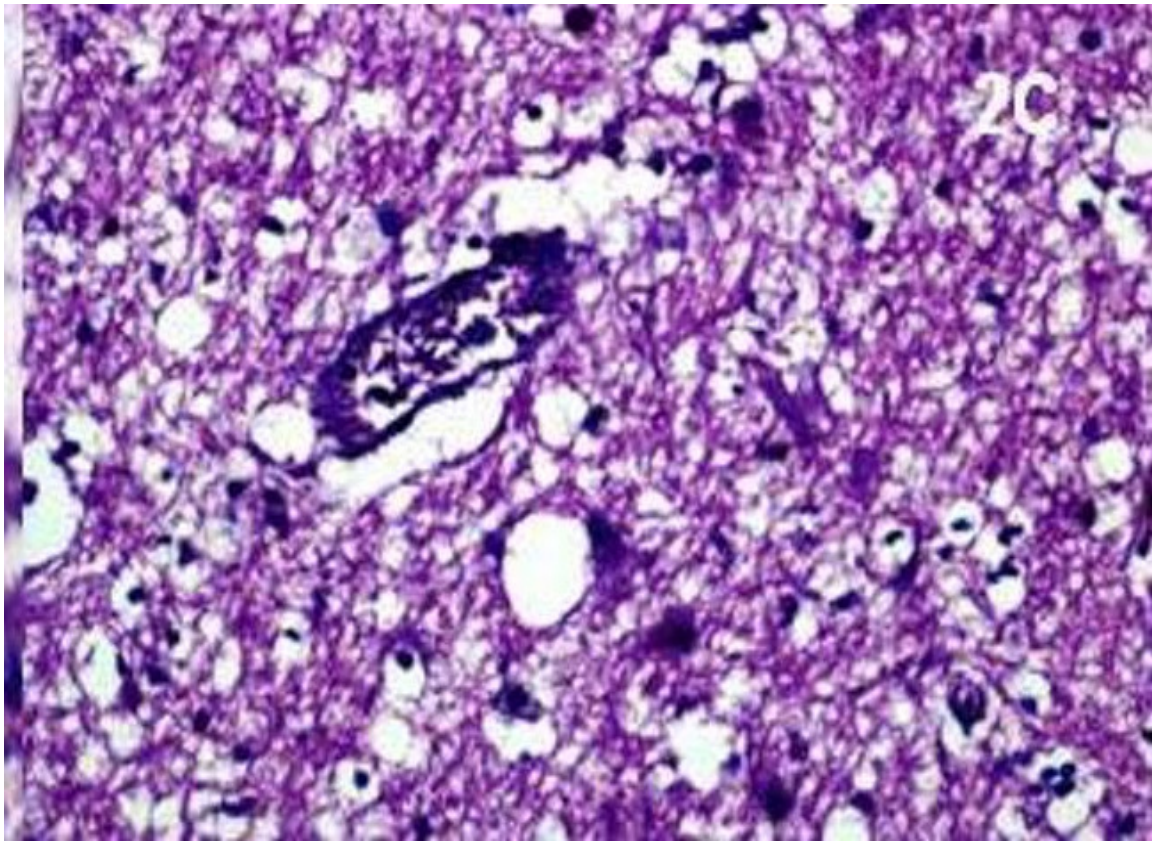


Fig 2C: Photomicrograph of brain showing edema with blood vessel containing sickled RBCs (H&E, x100)



Discussion

Sickle cell disorder (SCD) is remarkable for its clinical heterogeneity. Some patients have repeated episodes of admissions while others are totally asymptomatic. Although everyone with SCD shares the same gene mutation, there are five recognized haplotypes based on its origin. They are Bantu, Arab-India, Senegal, Benin, Cameroon and Central African Republic. The Central African patients have the worst prognosis while those from Senegal have the least form of the disease[3]. From the little history available, he had a virtually asymptomatic childhood & was apparently never diagnosed as having sickle cell disease. CT scan did not reveal any gall stones & there was no evidence of joint swellings, deformities or leg ulcers suggesting chronic disease.

There is a dearth of data on SCD in India as compared to that in Africa and America. Leg ulcers and priapism are said to be uncommon, while splenomegaly is common in Indian SCD. This is unlike most African or American patients who have non functional small spleens due to repeated infarcts [1,3]. There was no splenomegaly in the present case.

The strongest factor in SCT patients implicating intravascular sickling with tissue injury and even death is hypoxia. The decreased arterial PO_2 levels initiated events that lead to acidosis, excess lactate and intravascular sickling [4].

The patient had a very short history of illness following road traffic accident. He had evidence of breathlessness, anxiety and urinary tract infection. The patient's CT scan and autopsy suggested focal areas of infarction in the brain, lung and liver.

Acute chest syndrome is a severe and catastrophic complication of SCD and is characterized by chest pain, tachypnoea, fever, cough and arterial oxygen desaturation.

It can be severe with reported deaths of 4.3% in adults and is presumed to occur due to in situ sickling within the lung, producing pain and temporary pulmonary dysfunction [5,6]. The most frequent findings are rales. Infiltrates may be seen in the chest x ray, even though quite often it may be normal. Although there was no history of fever, chest pain or cough in the present case, he had rales and complained of breathlessness. Under these circumstances, a diagnosis of acute chest syndrome cannot be ruled out. Moreover he did not respond to the oxygen or ventilatory support. In addition to this, exchange transfusions must have been advocated in the treatment of acute chest syndrome[6], which was not done in the present case.

The patient's urine was turbid with pus cells indicating urinary tract infection. Provocative factors for sickle cell crisis include infection, fever, excessive exercise, anxiety, abrupt changes in temperature and hypoxia. Except for fever and excessive exercise all the precipitating factors were present in our patient. We believe all these factors precipitated sickle cell crisis and may have contributed to regional hypoxemias in the lung or even acute chest syndrome. During his present illness he was given fluids, analgesics, steroids and oxygen therapy but it could not prevent the cascade of events which resulted in sudden unexpected death. Exchange transfusions, which have been reported to improve survival, unfortunately could not be done due to lack of diagnosis.

Conclusion

Sudden death may occur in susceptible persons with SCT when poor physical conditioning, dehydration, heat stresses, anxiety or hypoxic states precipitate sickling of the abnormal erythrocytes. SCT may be overlooked as an etiological factor in sudden death. The initial set of investigations did not include a peripheral blood examination possibly because a hematological disorder was not suspected. This ultimately proved to be critical as a complete hemogram would have helped to recognize the impending disaster. Early recognition of this potentially fatal condition is crucial, as intensive supportive therapy would have prevented the catastrophic event.

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Multidisciplinary Approach for the Evaluation of Firearm Injuries

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Abstract

Evaluating firearm injuries for its manner of infliction is of major concern for the forensic surgeon as well as investigating agencies. The profound morbidity and significant mortality not only invites various forensic perspectives to be addressed, but also poses a challenging task to the forensic surgeon to deduce the manner of death. A case of fatal firearm injury, in an adult man with four firearm wounds in the neck is reported and discussed. The case apparently raised suspicion regarding the manner of death as 'suicide' due to the nature and disposition of wounds. A forensic autopsy supplemented with a retrospective evaluation of scene of occurrence and weapon of offence, reconstructed the event as deliberately inflicted by self.

Key words: Deliberate; Firearm injury; Scene of occurrence; Retrospective scene visit; Weapon.

Introduction

Evaluation of firearm related fatalities, are not deemed to be complete until a thorough approach is made from forensic autopsy, analysis of scene of occurrence and weapon of offence. While the former is done in a fairly reasonable manner, the latter two are compromised more often than not. In forensic practice, the scene of occurrence may be the place of the crime or incident that eventually led to the victim's death or the place of recovery of the victim's remains. Scene analysis is one of the most crucial elements of a forensic investigation into an unnatural death, whose value may exceed that of the autopsy itself, at times. Scene visit by the forensic surgeon when the body is 'in-situ' is perhaps more rewarding but the prevailing investigating system in the Indian sub continent provides a very minimal scope for such a practice. Hence majority of 'forensic evaluation of the scene' becomes retrospective, which is usually made after the autopsy, on the request of the forensic surgeon.

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A case of multiple firearm injuries, which possibly could not have been considered as suicide at autopsy is presented and discussed. The crucial information obtained from the retrospective scene visit, which included an examination of the alleged weapon of offence restructured the approach of arriving at the exact manner of death.

Case report

The case subject was an adult man who worked as an arm guard for a bureaucrat, at Mysore district, South India. He was found dead at his residence with four firearm injuries on front and back of the neck. A forensic autopsy was conducted at the department of Forensic Medicine and Toxicology, JSS Medical College, Mysore. As a pre-requisite, head and neck was radio-graphed for possible location of projectiles. A radio-opaque shadow suggestive of path traversed by projectiles was observed. However no projectiles could be visualized (Figure 1). On external examination, four circular penetrating wounds were present on front and back of neck. The said wounds were numbered as 1 to 4, for further evaluation. Wound No 1 was circular in shape, measured 1X1 cm and muscle deep, on right half of neck, 8 cm above sterno-clavicular joint (Figure 2). The margins were inverted with powder tattooing around

the adjacent area of 8X7 cm. On further dissection, underlying soft tissues showed blackening and charring. Wound No 2 was circular in shape, measured 2X1 cm, and muscle deep, on the left half of neck, 14 cm above the middle 3rd of clavicle (Figure 3). The margins were inverted, with blackening, smudging and abrasion of adjacent area. On further dissection, underlying soft tissues showed blackening and charring. Wound No 3 was oval in shape, measured 2X1.5 cm and muscle deep, on the left half of neck, 4 cm below the mastoid process (Figure 4). The margins were everted and irregular in shape. Wound No 4 was oval in shape, measured 2X1 cm and muscle deep, on the back of neck, 12 cm below the external occipital protuberance, with everted and irregular margins (Figures 5). With the observed findings, wounds numbered 1 and 2 were assigned as due to entry of the projectiles and that 3 and 4 were due to exit. No exact wound track could be established. However, there were diffuse contusions in the neck muscles. There were no other external injuries present on the person.

Other gross findings at autopsy were unremarkable, except for dried blood stains on face, neck, chest and a cherry red colored postmortem staining on the back. The cause of death was opined as hemorrhagic shock due to gunshot wounds sustained to the neck. A retrospective scene visit was made after 4 hours of autopsy. The room was said to have been secured from inside, which the investigating team had forced opened for the initial recovery of the body. The deceased was said to have found lying on the cot with legs resting on the floor and weapon held in left hand, the photograph of which was procured from the police (Figure 6).

Figure 1: Antero-posterior view of radiograph of neck, with a faint 'wound track' and no projectiles

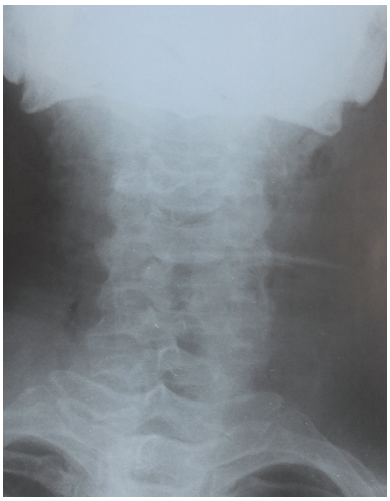

Figure 2: Entry wound on front of right half of neck

Figure 3: Entry wound on front of left half of neck

Figure 4: Exit wound on back of left half of neck

Figure 5: Exit wound on back of right half of neck

Figure 6: Attitude of the deceased with weapon in hand

The bed was found stained with blood. The adjacent wardrobe was found to be tethered by bullets over the outer wall and inner compartment, while the window had the effects of grazing bullet on the frame and grill. The concrete roof too had a recently incurred dent. This possibly would have caused by the richocheting of the bullets, after exit, whose exact sequencing could not be ascertained. The said firearm was found to be a *'semi-automatic submachine gun 9 mm 1A1'* (Figure 6), which would fire 5 shots on single trigger. The '35 slot' cartridge box, which was found nearby had 10 empty slots. This was concurring with the five empty cartridges recovered at the scene along with five live cartridges in the magazine.

Discussion

Suicides associated with multiple gunshot wounds are often uncommon in forensic practice[1]. Their identification raises significant suspicion regarding the participation of another person in the act, creating a dilemma about the manner of death. A reasonable interpretation of such injuries poses a significant challenge to the forensic surgeon. A multidisciplinary approach of a forensic autopsy, analysis of scene and examination of weapon of offence could positively affect the course of investigation.

Scene investigations involving the police and forensic specialists have been accepted as one

of the important tenets of a complete medico-legal inquiry in such cases[2].

In suicidal firearm injuries, the weapon of offence would usually be found at the scene and sometimes held in the hands of the victim, as was found in the present case. If it were to be cadaveric spasm, that would further clinches the diagnosis as 'self-inflicted'. Majority of the reported suicidal firearm injuries were by using pistol, with a few circumstances of shotgun related incidents[3]. Multiple firearm wounds in self-infliction may involve a solitary area, like head, or multiple areas, like head and chest. Multiple gunshot wounds confined exclusively to the head are the least common, whereas those of the chest are the most common[4,5]. The case subject had multiple firearm wounds in neck sparing the head and chest, which is in contrast with the retrieved literature. A reported study had observed that unusual sites for the suicidal gunshot wounds were the dorsal part of the neck, the right nostril and the right ear[6].

The make-up of the weapon had explained the multiple injuries sustained by the deceased subject. A plausible restructuring of the incident revealed that, the man was reportedly suffering from domestic discords, confined himself in a room, secured bolt, shot himself at neck with a *'semi-automatic submachine gun 9 mm 1A1'*. A single firing had expelled 5 projectiles, whose empty cartridges were recovered at the scene. The magazine had 5 live cartridges and the cartridge case of 35 slots, had 10 empty *niches*. Thus a positive conclusion of the manner of death was made as 'suicidal'. Hence it necessitates the need of acquiring the knowledge of nomenclature and operation of commonly used firearms in the geographical area of the forensic surgeon, which would be rewarding in explaining multiple firearm injuries.

Conclusion

Differentiation between suicidal and homicidal firearm injuries often becomes difficult owing to the presence of more than one firearm wound. The issue of homicide should often be ruled out in such cases, after a careful evaluation. This is best done by correlating the morbid anatomical findings at autopsy with the analysis of death scene and weapon of offence. A retrospective scene visit must be contemplated when the nature of injuries are of doubtful origin, or of unfamiliar pattern. Such visit will afford the forensic surgeon with an appreciation of the nature of the surroundings, so as to offer an objective opinion for the overall judicial inquiry of the case.

Conflict of interest

The third author has presented this case report under oral presentation in the VIII

annual conference of South India Medicolegal Association (SIMLA) held at

Calicut, Kerala, India.

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Trauma Misleading a Natural Death: A Case Report

Shankar M Bakkannavar*, Manjunath S*, Vinod C Nayak, Pradeep Kumar G*****

Abstract

Major component of Forensic Pathology is its ability to recognize and interpret the injuries and determine its role in causing death. It becomes more complicated in sudden deaths, wherein there are both significant external mechanical injuries and internal natural lesions. Meticulous autopsy plays an important role in unravelling such deaths.

Sudden death due to cardiac cause is the most common pathology encountered at autopsies. Diseases of the heart account for approximately 90% of all sudden deaths due to natural disease, with atherosclerotic coronary artery disease being the underlying cause of approximately 75 - 90% of sudden cardiac deaths. Autopsy studies indicate that 8 – 20% of deaths following myocardial infarction are due to free wall myocardial rupture.

We here by present a case of sudden death of 75 years old lady who was brought dead to hospital with external injuries to head after fall in bathroom. But after autopsy we were able to attribute cause of death due to rupture of left ventricular wall and not due to head injury.

Keywords: Sudden deaths; Myocardial Infarction; Haemopericardium.

Introduction

Certain cardiac conditions like myocardial infarction (MI), rupture of free wall, arrhythmias etc can be prompted by minor trauma. Sometimes these cardiac insults may lead to fall and eventual death of the individuals. MI and cardiac arrhythmias may not leave any significant findings supporting their occurrence at autopsy making the forensic pathologists' job more difficult. But in case of cardiac tamponade, obvious autopsy features are present.

External trauma like head injury may mask the condition if the incomplete autopsy is performed. Timely diagnosis and treatment of this life threatening condition could have saved the life of the deceased. Hence meticulous autopsy is important even in traumatic deaths where external injuries are obvious, for the reason that, cardiac lesions may be missed. This can result in misleading conclusion as to the cause of death.

Cardiac rupture is a rare complication of acute myocardial infarction and represents the second cause of death after cardiogenic shock[1,2,3]. Most patients with cardiac rupture may succumb almost instantaneously due to cardiac tamponade with rapid, irreversible, elec-tromechanical dissociation[4,5,6].

In this paper we highlight importance of intelligent and a timely diagnosis of the life threatening cardiac tamponade during life and importance of meticulous autopsy of the case after death in morgue.

Case report

A 75 yrs old female slipped and fell down while going to bathroom early in the morning. Immediately she was taken to the emergency department of hospital in an unconscious state. On examination by the attending physician, the patient was declared brought

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dead. The dead body was sent to the mortuary for autopsy.

The autopsy was conducted on the same day. On external examination, the dead body was of a female with moderate built. The face was markedly congested. There was a split laceration over the head in occipital region (Figure 1) with corresponding scalp contusion. No other external injuries were present over the body. On internal examination a large amount of blood clot, measuring 200 gm, was found inside the pericardial cavity (Figure 2). The heart was enlarged weighing 476gm. Two large tears, measuring 4cm X 1.5cm and 3cm X 1cm with irregular margins communicating with the left ventricular cavity were present over antero-lateral and posterior surface of left ventricular wall (Fig 3). Hyperemia of surrounding myocardial tissues was also noticed. Left ventricular wall hypertrophy present and the walls of all major coronaries were calcified. All internal organs were congested.

Histopathological examination of the heart revealed the showing the coagulative necrosis of the myocardial fibres and neutrophilic infiltration suggestive of acute myocardial infarction (Fig 4) leading to rupture of the ventricular wall (Fig 5). Fibrosis of the ventricular wall (Fig 6) was suggestive of old myocardial infarction.

Psychological autopsy from the relatives revealed the significant past medical history of the decrease was a known hypertensive.

The cause of death given was cardiac tamponade consequent to rupture of left ventricular wall secondary to acute myocardial infarction.

Figure 1: Split laceration over the scalp

Figure 2: Haemopericardium

Figure 3: Ventricular wall ruptures

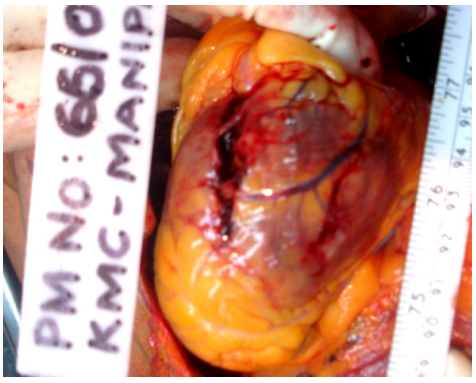


Figure 4: Acute myocardial infarction: Section shows an area of coagulative necrosis and neutrophilic infiltration (Heamotoxylin and Eosin, 20X)

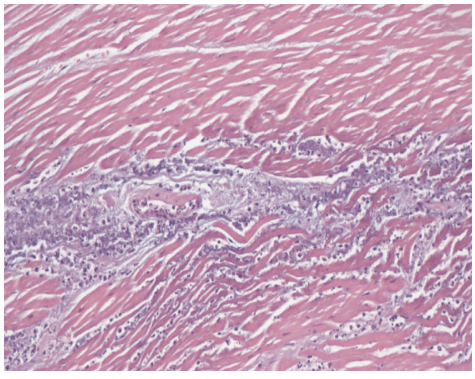


Figure 5: Ruptured ventricular wall (Heamotoxylin and Eosin, 10X)

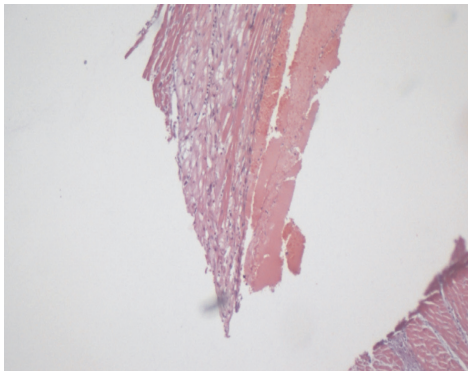
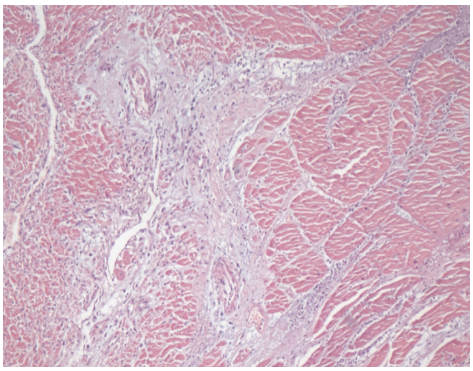


Figure 6: Old myocardial infarction: Section showing fibrosis of the myocardium (Heamotoxylin and Eosin, 20X)



Discussion

Cardiac tamponade is caused by a large or uncontrolled pericardial effusion[7]. Common aetiologies include blunt or penetrating trauma, surgical complications, sequelae from myocardial infarction and effusion[8,9]. The factors which either predispose or in-crease the risk of cardiac rupture complicating an acute myocardial infarction are: female gender, older age (> 65 years), first myocardial infarction (frequently transmural), severe one-vessel coronary artery disease with a lack of collateral formation, absence of pre-vious angina[10,11,12] and sudden or progressive hypotension, and sudden electromechanical dissociation[13]. In our case four of the above five risk factors were evident from the history and post-mortem examination. The presence of multivessel disease and a history of previous myocar-dial infarction may exert a protective effect, probably linked to development of greater collateral circulation and a better tolerance to wall traction, respectively[14]. Eighty-five percent of ventricular wall ruptures occur within the 1st week and 40% within the first 24 hours after myocardial infarction. The rupture is frequently caused by an increase in wall tension in the zone where necrosis and ischemia have created dilatation and thinning of the myocardium[15].

Sometimes the cases having external injuries may mask the existing disease in the body. As in this case, the head injury masked the myocardial infarction. Examination of heart revealed haemopericardium secondary to the rupture of Left ventricle due to Myocardial Infarction thereby enabling us to opine regarding the cause of death.

Conclusion

It is vital to establish the relation between the trauma and the disease to know whether the trauma has triggered the diseased process or the disease has lead to the trauma before final opinion. Sometimes trauma can mislead the forensic pathologist while ascertaining the cause of death. So it is essential to take utmost care while dealing with cases with minimum external injury. As deaths are common in old age persons following minimum trauma, the natural causes of death should not be overlooked.

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