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Case Report

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A Rare Case of Tremor Induces by Cycloserine in Drug-Resistant Tuberculosis Patient

Palmalina Anggita Indah Swasti[1], Citra Dewi Ameliya[2], Nur Prasetyo Nugroho[3]

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Abstract

Background: Tuberculosis is a contagious disease that generated by *Mycobacterium tuberculosis.* Drug-Resistant tuberculosis (DR-TB) is inculpated the use of the second-line anti-tubercular treatment which is associated with many drug side effects or so called, Adverse Drug Reactions (ADR). Cycloserine (Cs) is an important drug against drug resistant tuberculosis (DR-TB). Cycloserine has been used in tuberculosis therapy since the late 1950s. Identical with most drug, Cycloserine can cause many Adverse Drug Reactions (ADR).

Case Illustration: A 23-year-old woman diagnosed with drug-resistant tuberculosis is undergoing long-term treatment. The patient received treatment for DR-TB with the Bdq-Lfx-Cfz-Cs-E regimen. After the patient underwent the 10th month of advanced phase treatment, the patient complained of shaking in both hands (tremors). The tremor is felt to be more severe in the right hand and the patient cannot grip objects tightly.

Discussion: Cycloserine (Cs) play an important role in second-line drug management of DR-TB. Cs-Induced psychosis and other neurological side-effects can be detrimental towards patients yet they are rarely reports in DR-TB cases. Cs is correlated with severe psychiatric cases and Central Nervous System related ADRs. Cs-associated ADR is most likely because of production of gamma-aminobutyric acid as a result of inhibition of glutamic decarboxylase. Study Shown that among 132 patients who reported side effects in the cycloserine group, 2 (1.4%) experienced major side effects, namely tremors. Side effects possibly or probably related to Cs appeared after a median of 71 days (range 10–331 days) of Cs treatment.

Conclusion: the drug side effects such as tremors are very rare in drug-resistant tuberculosis patients. In this case, the patient's complaint of tremors could be caused by cycloserine as an anti-tuberculosis drug.

Keywords: Drug-Resistant Tuberculosis, Cycloserine, Tremor, Adverse Drug Reaction

Introduction

Drug-resistant tuberculosis (DR-TB) remains a major health problem in Indonesia. Tuberculosis is an contagious disease caused by bacteria infection Mycobacterium tuberculosis.[1] This disease affects the lung parenchyma (pulmonary TB), this bacteria

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also can infect other organs (extra pulmonary TB). Tuberculosis (TB) is one of the highest death threats around the world.

Drug-resistant tuberculosis (DR-TB) is a threat to control among the health workers, is the enemy among the world. Statistically in 2019, estimated that 3.3% of active tuberculosis patient and 17.7% of reinfection patients is a drug-resistant patients. In Indonesia alone, the estimated DR-TB is 2,4% of tuberculosis patients and 13% of reinfection TB with total incidence of 24.000 cases or 8.8/100.000 populace. Study shown in 2019, around 11.500 Rifampicin-resistant TB (RR-TB) patients was found, around 48% of patients started second-line TB management with 45% success rate.[2]

The drug-resistant tuberculosis (DR-TB), for example multidrug-resistant tuberculosis (MDR-TB) is involves in second-line anti-tubercular treatment (ATT). This treatment is associated with multiple Adverse Drug Reactions (ADR). Cycloserine (Cs) (D-4-amino-3-isoxazolidine) is a very important second-line drug used in the management of MDR-TB.

Cs-Induced psychosis and other neurological side-effects can be detrimental towards patients yet they are rarely reports in DR-TB cases. Cycloserine, a cyclic analog to D-alanine, that targetalanine racemase and D-alanine ligase, thus blocking the formation of the bacterialcell wall.[3] Cycloserine has been used in TB therapy since the late 1950s.

Case Illustration

A 23-year-old woman complained of a cough with phlegm for one month, fever at night, weight loss of around 3 kg (from 48 kg to 45 kg), and decreased appetite. The patient went to the Community Health Center and underwent a rapid molecular test (Gene Xpert) examination with results of Rifampicin Resistance. The patient doesn't have any precursory history with TB treatment and doesn't have any trace with other tuberculosis patient. The patient went to Muhammadiyah Ahmad Dahlan Kediri Hospital on August 1, 2022. The patient underwent a baseline examination before starting treatment. On physical examination, rhonki in the upper ⅔ of the right hemithorax. The patient's weight is 45 kg with a height of 156 cm, and the patient's body mass index is 18.49 (underweight). The results of the chest X-ray examination showed infiltration at the apex pulmo dextra with minimal lesion. On the 2nd line LPA (Line Probe Assay) examination, Mtb was Not Detected. Still, on the DST (Drug Sensitivity Test) examination, the results were Sensitive on H DT, Lfx, Mfx DT, Amk, Bdq, Lzd, Cfz, Z. The patient decided to start treatment on August 9, 2022 with a short-term regimen (Bdq-Lfx-Cfz-E-H-Eto-Z).

After undergoing treatment for 25 days, the patient often complained of nausea, vomiting, and haematemesis. Based on the patient's complaint, the treatment was stopped because she was intolerant to Ethionamide. The patient restarted treatment with a long-term regimen (Bdq-Lfx-Cfz-Cs-E) on September 6, 2022.

After the patient underwent the 10th month of advanced phase treatment with the Lfx-Cfz-Cs-E regimen, the patient complained of shaking in both hands (tremors). Tremors are felt to be more severe in the right hand, tremors occur in the hands during activity and at rest. Patients complain of being unable to grip objects tightly, which interferes with daily activities. The patient was consulted by a Neurology Specialist and received Trihexyphenidyl 2x1 mg and Mecobalamin 500 mcg 1x1 for one month. The evaluation showed that the tremors reduced after one month and the patient was able to carry out activities well. However, in the 15th month of treatment, the patient complained of tremors in both hands returned with a lighter intensity. The Cycloserine was stopped for two months accompanied by the administration of mecobalamin 500 mcg 1x1 without Trihexyphenidyl. As a result of discontinuing cycloserine, the patient's tremor complaints were reduced very significantly.

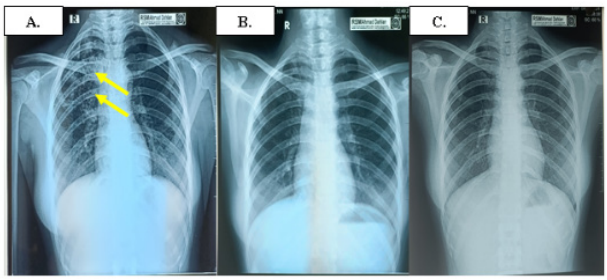

Figure 1.

A. Chest X-ray before anti-tuberculosis therapy, showing infiltrates in the upper middle field of the pulmodextra (showing pulmonary TB)

B. Fibro-infiltrates improvement, after 6 months with anti-tuberculosis therapy,

C. Completed therapy of anti-tuberculosis for 18 months.

Figure 2: Tremors in the patient's hands

Discussion

Treatment of drug-resistant TB uses second-line therapy, one of the drug used in the treatment of drug-resistant tuberculosis is cycloserine which has neurological side effects when used. a cyclic analog to D-alanine, target alanine racemase and D-alanine ligase, thus blocking the formation of the bacterialcell wall.[3] Cycloserine has been used in TB therapy since the late 1950s[4–6] Cycloserine is used as second-line therapy for group B drug-resistant TB at a with dose of 10-15mg/kg. Studies shown, Cycloserine can cause psychiatric side effectsand neurotoxicity.[6]

Cs-Induced psychosis and other neurological side-effects can be detrimental towards patients yet they are rarely reports in DR-TB cases. Cs is correlated with severe psychiatric cases and Central Nervous System related ADRs. Cs-associated ADR is most likely because of production of gamma-aminobutyric acidas a result of inhibition of glutamic decarboxylase.[7] A study conducted by Li Y, et al (2019) reported that 2 of 132 patients who reported side effects in the cycloserine group (1.4%) experienced serious side effects, namely tremors.[4] In a retrospective study conducted by Pratibha S,etal. (2020), 3 out of 89 patients who used cycloserine could cause neurotoxic side effects which were known from neuroimaging changes in the form of restriction in the caudate nucleus which resulted in motor symptoms.[6,8] A study also shows that Cs itself can cause neurological side effects due to its ability to penetrate the brain barrier and work as an NDMA agonist which causes motion sickness, sleepiness, depression, vertigo, confusion, dysarthria, paresthesia, hyperirritability, seizures, tremors and psychosis.[9]

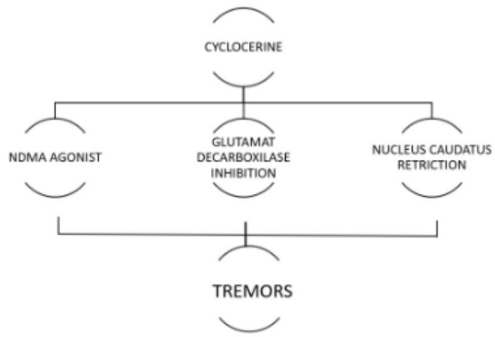

Figure 3: Mechanism of Cycloserine Induction of Tremors

In this patient, the neurological side effect that occurred was tremors, which were experienced in the 10th month of advanced phase treatment. As stated by Li Y, et al (2019) in the retrospective study on 144 patients shows that the effects of Cs is possible. It appears after a median 71 days (range 10–331 days) ofCs treatment.[4]

When complaints of tremors occurred, the patient was consulted by a Neurology Specialist and received Trihexyphenidyl 2x1mg therapy and Mecobalamin 500 mcg 1x1 for one month. The patient has undergone

a thyroid function test and is not taking any other medications that could cause tremors. This was done to rule out other potential causes of the tremors aside from cycloserine. Evaluation of this therapy showed that tremors were reduced and the patient was able to carry out activities well. This is by Meijer et. al (2019) that Trihexyphenidyl is given to stop drug-induced tremor symptoms with a minimum recommended dose of 1 mg per day until the patient can control the tremors symptoms they are suffering from.[10]

According to research conducted by Li Y, et. al (2019), patients who experienced side effects from cycloserine were stopped from treatment for 6 months to minimize side effects. In a case series conducted by Yadav et al, (2019), patients who experienced neurological side effects and psychosis were temporarily discontinued with cycloserine to overcome the side effects that occurred. This is consistent with the patient that complaints of tremors reappeared in the 15th month of treatment, then Cycloserine was stopped for 2 months (accompanied by the administration of mecobalamin 500 mcg 1x1 without giving Trihexyphenidyl).[4,7] As a result of stopping cycloserine, the patient's complaints of tremors were reduced very significantly.

The side effect of tremor associated with cycloserine has been listed by the brand/ manufacturer. However, this information is not included in the technical guidelines for managing multidrug-resistant tuberculosis (MDR-TB) in Indonesia. Tremors in MDR-TB patients are rare and have not been reported in Indonesia, and patients have been informed about this side effect. Therefore, this case finding has been reported to the TB program managers and local health authorities to be considered for inclusion in the next update of the MDR-TB technical guidelines.

Conclusions and Recommendations

Drug-resistant tuberculosis (DR-TB) is leaded by theaversion of Mycobacterium tuberculosis (Mtb) bacteria mutation in chromosome. DR-TB requires complex management with treatment consisting of various anti-tuberculosis drugs. Interactions with drug use have various side effects and each patient has different complaints.[11] This patient reported side effects in the form of tremors that appeared in the 10th month of treatment and recurred in the 15th month of treatment. Drug side effects such as tremors are very rare in drug-resistant tuberculosis patients. In this case, the patient's complaint of tremors was caused by cycloserine as an anti-tuberculosis drug because after stopping cycloserine, the patient's complaints of tremors reduced very significantly. Even though when the tremor complaints first appeared, cycloserine had not been stopped and only Trihexyphenidyl and Mecobalamin were given so the tremor recurred in the 15th month of treatment. If side effects such as tremors occur in DR-TB patients, what can be done is to immediately stop cycloserine permanently. All patients with multidrug-resistant tuberculosis (MDR-TB) undergo a comprehensive examination every 6 months for 2 years after treatment.

Limitation

There was no objective and measurable examination of the tremor symptoms experienced by the patient. The patient did not undergo a head CT scan and MRI to rule out the possibility of other brain lesions.

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Conflicts of interest: No conflicts of interest

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Original Research Article

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Sociodemographic and Pathological Study of Sudden Death Among Neonates and Infants: An Autopsy Based Study

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Abstract

Children dying within the first year of life is referred to as infant mortality and is an important key indicator for a country's health and standard of living. Every year, there is an estimated 4.5 million infant deaths around the world, accounting for almost 75% of deaths in children younger than 5 years. The studies based on infant deaths are relatively less in number worldwide. This study investigates the sociodemographic and pathological aspects of infant deaths through autopsy data.

The objective of the study was to evaluate the pathology and causes of infant/neonatal deaths and analyze related social and demographic factors.

A cross-sectional descriptive autopsy study was conducted at the Government Medical College, Kozhikode, covering 66 medicolegal infant death cases from April 2018 to October 2022. Data were collected via questionnaires and analyzed using SPSS software.

Respiratory infections (37.14%) were the leading cause of infant deaths, while perinatal complications and congenital abnormalities each accounted for 25% of neonatal deaths. Most deaths occurred in the postneonatal period (77.1%), predominantly among male infants (63%) from rural areas (84.3%). Key findings included consolidation and bronchopneumonia in lung examinations.

Significant associations were found with various factors, including the period of infancy, delivery type, co-sleeping history, and prior hospitalizations. Birth weight and histopathological lung findings were linked to sudden infant death syndrome (SIDS).

Keywords: Infant death; neonatal death; Sudden Infant Death Syndrome.

Introduction

Public health organizations, decision-makers, and governments utilize the infant mortality rate as a measure to assess the general level of pediatric

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health among a certain population living within geographically specified limits. The number of infant deaths per 1,000 live births is used to express the rate[1]. Infants' health and mortality status have been referred to as a synoptic indicator of the social conditions in a community (Gortmaker and Wise 1997)[2]. India has the highest infant mortality, accounting for around 23% of all infant deaths worldwide. According to the sustainable development goal, by 2030, preventable deaths of newborns should be ended, with all nations striving to reduce neonatal mortality to at least as low as 12 per 1000 live births[3].

Infant death is most often a product of multi factorial interplay and has a detrimental effect on the mental and physical health of the parents and even the whole family. Most often, there may be little or no symptoms in infants prior to death and may leave a doubt as to the cause of death in both parents and the attending physician. This is where the role of a forensic pathologist becomes crucial. Even then, no cause of death could be attributed to some of the cases of infant deaths after complete laboratory investigations. Though there were studies on socio economic, demographic and regional variations associated with infant deaths, autopsy based studies are relatively less in Kerala, India. Furthermore, this study also gives emphasis on the factors tied to Sudden Infant Death Syndrome, an apparent natural death in infants.

Materials and Methods

Objectives:

(i) To evaluate the pathology of infant/ neonatal deaths (gross and microscopy) and to analyze the cause of infant /neonatal deaths.

(ii) To study the social and demographic factors related to infant /neonatal deaths.

Study Design: Cross sectional study

Setting: All cases of sudden death in children less than one year of age subjected for medicolegal autopsy done at Government Medical College, Kozhikode over a period of 4.5 years.

Study period: April 2018 to October 2022

Sample size: 66 [As per the study conducted by Yanfei Deng et.al, 60.9% of infant deaths were due to respiratory infection (p=60.9)]

Sampling procedure: Autopsy of the infants brought to the Department of Forensic Medicine, Government Medical College, Kozhikode were done to analyze the cause of death and appropriate samples were collected from the body for pathological and / or toxicological studies. An informed consent was obtained from the close relative of the deceased baby and a detailed history of the deceased baby and adequate history of the parents were also taken. Retrospective data was collected through medicolegal records and also through concerned Police Officials. Standard weight-for-age of the infants was calculated using WHO growth chart (in term babies) and Fenton's chart (in preterm babies) and the grade of malnutrition was assessed as per the IAP classification of malnutrition.

Study variables:

Details of the baby at the time of death (age, weight, sex, residence)

Year, month, season and time of death

Delivery details

Details of parents

Autopsy findings-gross and microscopy.

FINDINGS

70 cases of infant deaths were studied and analyzed using SPSS version 18 software. Associations with a p-value of 0.05 or less is taken as statistically significant.

In the current study, maximum number of infant deaths occurred due to respiratory infection (37.14%), followed by aspiration of stomach contents (18.57%). The least number of deaths occurred due to other infections (2.86%).

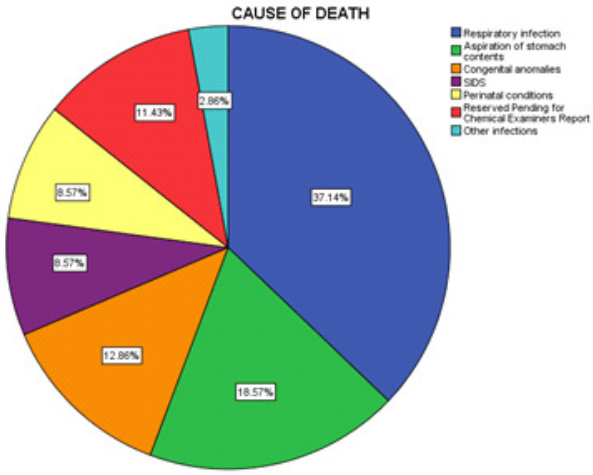

Figure 1: Distribution of cause of death in infants

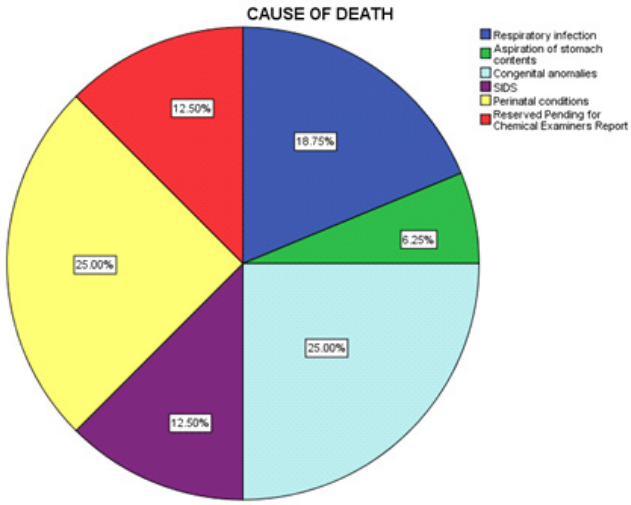

Figure 2: Distribution of cause of death in neonates

Table 1: Distribution of description of cause of infant death

	Frequency	Percent
Respiratory infections	20	28.6
Aspiration of stomach contents	12	17.1
Congenital anomalies	8	11.4
Delayed complication of HIE	1	1.4
SIDS	6	8.6
Reserved Pending for chemical examiners report	8	11.4
Perinatal conditions	4	5.7
Miliary TB	1	1.4
Bronchopneumonia + microcephaly	1	1.4
Myocarditis	1	1.4
Aspiration + congenital heart disease	1	1.4
Respiratory infections + congenital heart disease	3	4.3
Respiratory infection + purulent meningitis	1	1.4
Congenital storage disorder	1	1.4
Intracranial hemorrhage	1	1.4
Respiratory infection +Glycogen storage disease	1	1.4
Total	70	100.0

Table 2: Distribution of sex in infant deaths

Sex	Cause of death							Total
	Respiratory infection	Aspiration of stomach contents	Congenital anomalies	SIDS	Perinatal conditions	RPCER	Other infections	
Female	12	3	1	2	3	3	2	26
	46.2%	11.5%	3.8%	7.7%	11.5%	11.5%	7.7%	100.0%
Male	14	10	8	4	3	5	0	44
	31.8%	22.7%	18.2%	9.1%	6.8%	11.4%	.0%	100.0%
Total	26	13	9	6	6	8	2	70
	37.1%	18.6%	12.9%	8.6%	8.6%	11.4%	2.9%	100.0%

P=0.206

Table 3: Distribution of period of infancy in infant death due to respiratory infection

Neonates	Respiratory or non respiratory cause of death		Total
	Respiratory infection	No respiratory infection	
Neonates	3	13	16
	18.8%	81.3%	100.0%
Postneonates	24	30	54
	44.4%	55.6%	100.0%
Total	27	43	70
	38.6%	61.4%	100.0%

p=0.064

Table 4: Distribution of residence in infant deaths due to respiratory infection

Residence	Respiratory or non respiratory cause of death		Total
	Respiratory infection	No respiratory infection	
Rural	20	39	59
	33.9%	66.1%	100.0%
Urban	7	4	11
	63.6%	36.4%	100.0%
Total	27	43	70
	38.6%	61.4%	100.0%

P=0.063

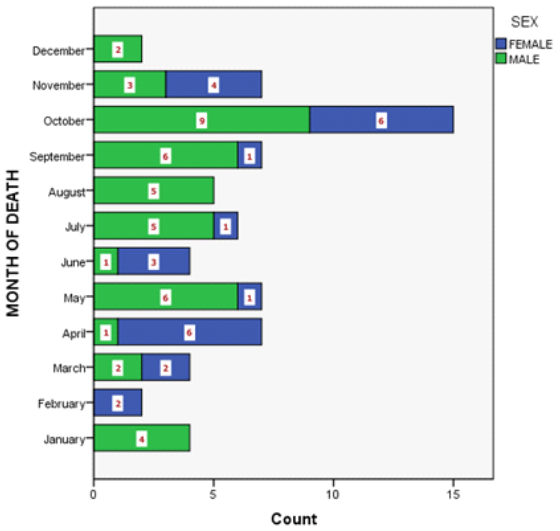

Figure 3: Distribution of infant deaths according to the month of death

Among 70 cases, 3 neonates and 24 post-neonates had respiratory infections, while 43 died from other causes, showing a significant correlation ($p < 0.05$). SIDS occurred in 6 cases, mostly post-neonatal (4) and males (66.7%), but the associations were not significant. Respiratory infection deaths were common in rural areas (74%) and most occurred in October (21.4%). The association between the cause of infant death and the month of death was statistically significant ($p = 0.007$). In Kerala, there were seasonal variations in causes of death, with respiratory infection deaths high during the monsoon season (48.6%). Deaths peaked early morning (22.9%) but was not statistically significant. Most deaths were term babies (84.3%). Normal deliveries were 61.4%, C-sections 35.7%, and vacuum/forceps 2.9%, with a significant association ($p = 0.009$).

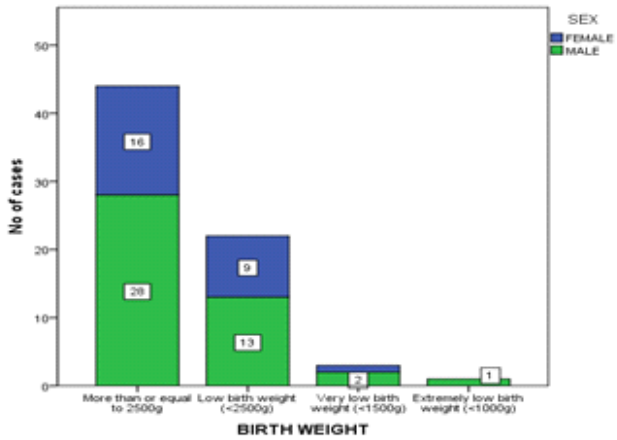

Figure 4: Distribution of birth weight in infant deaths

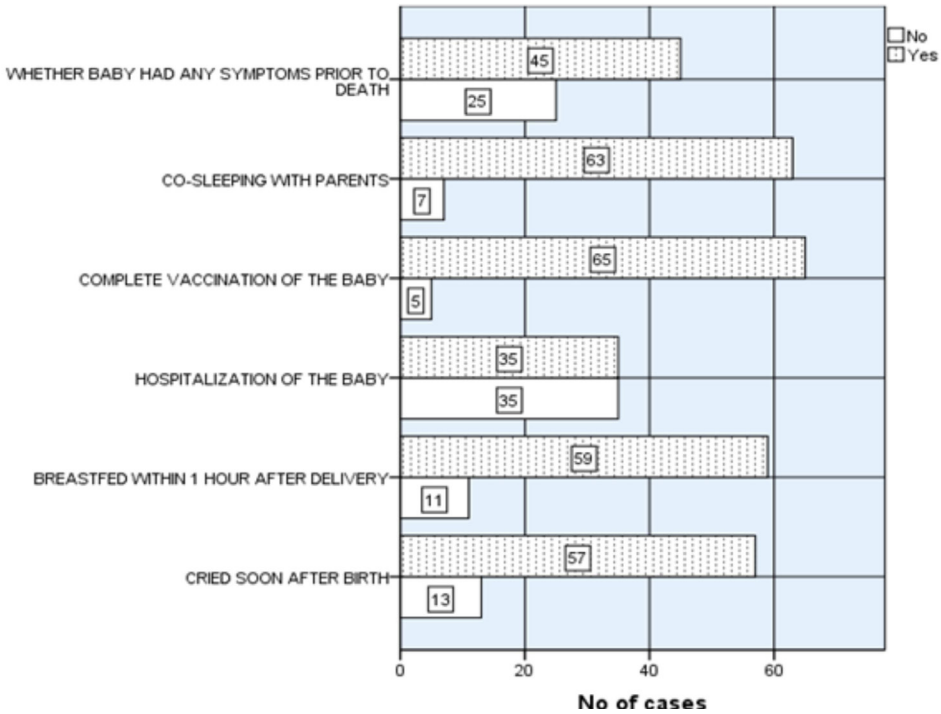

Figure 5: Distribution of details of infants after delivery in infant deaths

The study found a significant association between being breastfed within an hour of birth and infant death causes (p=0.010), as well as between prior hospitalizations and congenital anomalies causing death (p=0.009). Out of 45 cases with symptoms before death, 13 were due to congenital anomalies (p=0.013). A significant link was also found between cosleeping and infant death (p<0.05).All six cases of SIDS involved a history of cosleeping with parents but was not statistically significant. Most infants (87.1%) were from non-consanguineous marriages, with no significant associations found for family histories of sudden infant deaths or socio-economic status.

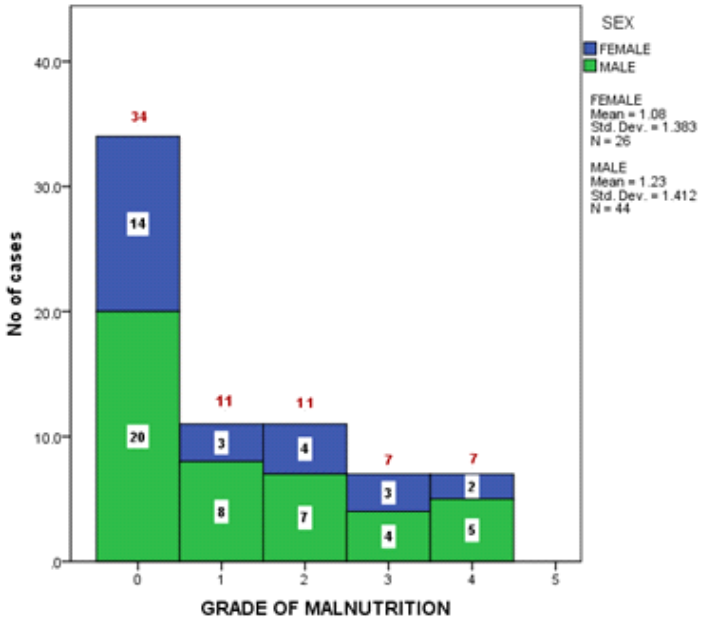

Figure 6: Distribution of nutritional status in infant death

There was no statistically significant association between grade of malnutrition and cause of infant death.

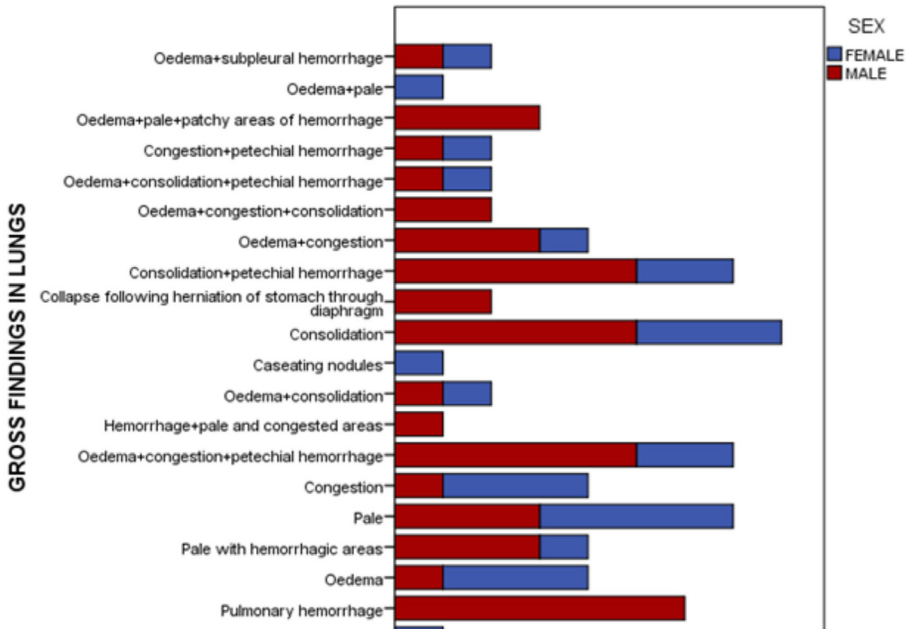

Figure 7: Distribution of gross findings in lungs in infant deaths

In this study, 20 cases showed brain congestion and 10 had edema; 7 had edema alone. One case had purulent CSF. Most brain histopathology was unremarkable. Bronchopneumonia was common in lungs; 21.7% had lung hemorrhage. Heart was normal in 75.7% of cases, with 10% showing congenital heart disease. Eight had epicardial petechial hemorrhage. Liver congestion was seen in 40%, fatty changes in 2.8%, and one case each of cirrhosis with biliary atresia and miliary TB. Kidney congestion appeared in 47.1%, with 14.3% pale. Spleen histopathology showed 40% congestion, and 20% were unremarkable. Adrenal glands showed 25.7% congestion and 15.7% were pale.

Table 6: Distribution of major gross and histopathological findings of internal organs in cases of SIDS

ORGAN	GROSS FINDING	HISTOPATHOLOGY	
BRAIN	Congestion : 83.3%	Unremarkable : 50%	
LUNGS	Pulmonary haemorrhage: 33.3%	Intra alveolar haemorrhage + pulmonary oedema : 33.3%	
	Petechial haemorrhage+ oedema+ congestion	16.7% each	Congestion : 33.3%
	Patchy areas of haemorrhage+ oedema+ pale		Congestion + haemorrhage : 16.7%
	Pale		Oedema+ peribronchial inflammation : 16.7%
	Oedema + congestion		
HEART	-	Unremarkable : 83.3%	
LIVER	Unremarkable : 66.7%	Unremarkable : 50%	
	Congestion : 33.3%	Sinusoidal congestion :50%	
KIDNEY	Unremarkable : 50 %	Congestion :83.3%	
	Congestion :66.7%	Unremarkable : 16.7%	
SPLEEN	Congestion :66.7%	Congestion :66.7%	
	Unremarkable : 33.3%	Unremarkable : 33.3%	
ADRENAL GLANDS	Unremarkable : 83.3%	Unremarkable : 50%	
	Congestion :16.7%	Congestion :33.3%	
THYMUS	Unremarkable : 66.7%	Unremarkable : 33.3%	
	Congestion : 16.7%		
AIRWAYS	Unremarkable : 50%		

Discussion

In this study, respiratory infections were the leading cause of infant deaths, accounting for 37.14% of cases. Among these, 53.8% were male infants and 46.2% were female. Aspiration of stomach contents followed, contributing to 18.57% of total deaths. Congenital anomalies, including heart defects and pulmonary conditions, accounted for 12.86% of deaths. Sudden Infant Death Syndrome (SIDS) and perinatal conditions each constituted 8.57% of cases.

Comparatively, in Deng et al.'s study(2019) in China, infectious diseases were the primary causes of infant mortality. These included pneumonia, meningitis and viral brainstem encephalitis.

Respiratory infections accounted for 60.9% of total cases (28 out of 46 infant deaths), with pneumonia being the leading cause (24 cases out of 28). Diseases of the nervous system and cardiovascular system disorders accounted for 17.4% & 4.4% of total deaths. Sudden Infant Death Syndrome (SIDS) constituted 4.4% of the total deaths in their study[4].

In a similar study by Tumer et.al, respiratory system pathologies accounted for 35% of deaths and SIDS contributed 19.58% of the total cases in infants aged 1-12 months[5]. A study by Vaid et al. found that 23.3% of total infant deaths were due to gastroenteritis[6].

In this study, neonatal deaths were largely due to perinatal conditions and congenital anomalies, each at 25%. Respiratory infections caused 18.75% of deaths, SIDS accounted for 12.5%, and 12.5% had unexplained causes. There was a significant association between cause of death and neonatal and post neonatal period.

77.1% of cases were infants older than one month, and 22.9% were neonates in our study.Male infants comprised 62.9% of the study population, with SIDS affecting 66.7% of male infant deaths.

Most deaths occurred in rural areas (84.3%).93% of aspiration deaths were in rural areas, where it was significant in 67.8% of cases. Respiratory infections and SIDS were also more common in rural areas but not significant. Gupta's 2021 study found over 70% of deaths in rural India, likely due to limited healthcare access[7].

Infant mortality rates peaked in October (21.4%) in this study & the month of death was significantly associated with the cause of death. Conversely, Gardner et al. found higher mortality in winter[8] and a Belgian study noted excess deaths in January-February and August[9]. Most deaths occurred during the monsoon season (52.8%) & most deaths (42.9%) occurred in the early morning hours (3am-9am), but with no statistical significance.

Birth in hospitals via normal vaginal delivery (61.4%) was statistically associated with causes of death, particularly in cases involving vacuum assistance.

The majority of infants (84.3%) were term births, and 62.9% of total cases were born with normal birth weight. In Western and Southern India, prematurity and low birthweight contributed to a larger share of child deaths[10]. Black et al. found that SIDS occurs more frequently in low birth weight infants[11].

Among those who did not cry after birth, the majority died from perinatal conditions (30.8%) or respiratory infections (30.8%), and this difference was statistically significant.Early breastfeeding (84.3%) showed significance in reducing mortality. In hospitalized cases, 34.3% had congenital abnormalities, and this was statistically significant.

No significant link was found between birth order and SIDS in this study. While overall infant deaths increase with birth order, SIDS was highest in first-borns when mothers were young and less educated[12,13].

64.2% of cases showed symptoms before death, mostly due to respiratory infections (44.4%), which was statistically significant. In SIDS cases, symptoms were present in half and absent in the other half.

In our study, 87.1% of deaths were in infants from non-consanguineous marriages, with no link to cause of death, possibly due to the rarity of consanguineous marriages in Kerala. Other studies globally have shown that consanguineous marriages, especially first-degree ones, increase infant mortality[14].

In our study, 54.3% of cases were from BPL families. Respiratory infections were more common in APL families (57.6%) than BPL families (42.3%), while perinatal deaths were higher in BPL families (83.3%). Education levels were generally high, and 60% of fathers were unskilled laborers, with a significant link to cause of death. Morris Jn and Heady Ja also found infant deaths linked to the father's occupation[15].Malnutrition was noted in 51% of cases, with no significant link to SIDS though more than half of the SIDS cases (66.7%) in our study population were malnourished. Co-sleeping with parents was common (90%) but showed no significant statistical association with mortality causes.

In this study, lung consolidation was the primary finding. Of 46 histopathological reports, 26% showed bronchopneumonia, 21.7% had lung hemorrhage,

and 8.6% had epicardial petechial hemorrhages. Sinusoidal congestion of liver was seen in 45.5%, while kidney and spleen congestion was present in 47.8% and 53.6% (gross) and 54.8% and 64.3% (histopathological) cases, respectively. Adrenals and thymus were mostly unremarkable. Meconium was found in one case. In SIDS cases, 66.7% had lung hemorrhage, 33.3% had pulmonary edema or intra-alveolar hemorrhage, and 33.3% had lung congestion and was statistically significant.Kidney congestion was noted in 83.3% of SIDS cases. Other organs were mostly congested or normal, with 33.3% of SIDS cases having blood-stained froth in the airways.

Conclusion

In this study, respiratory infections were the leading cause of infant deaths, predominantly occurring in the post neonatal period (88.8%). Key findings included lung consolidation on gross examination and bronchopneumonia on histopathology. Other significant causes were aspiration of stomach contents and congenital anomalies, with SIDS and perinatal conditions each accounting for 10% of deaths.

Perinatal complications and congenital anomalies were major contributors to neonatal deaths, comprising 50% of cases, while SIDS and unexplained deaths made up 25%. Congenital storage disorders were responsible for 2.8% of deaths. Most deaths occurred in the post neonatal period (77.1%), primarily within the first six months (75.9%). Male infants (63%) and those from rural areas (84.3%) were most affected.

The highest mortality was in the month of October. Deaths predominantly occurred early in the morning (3 a.m. to 9 a.m., 42.9%) and were more frequent in the monsoon season (52.8%), with respiratory infections rising during this period (48.6%).

Factors linked to cause of death included the period of infancy, month of death, delivery type, crying history, breastfeeding within an hour, symptoms before death, co-sleeping, and father's occupation. Rural infants had higher aspiration-related deaths. Term and preterm babies had similar rates of perinatal condition deaths and majority of the total cases had a history of co-sleeping with their parents. Most infants were firstborns (48.6%). Among those with a birth order above three, 75% died of respiratory infections.

SIDS was notably prevalent among first-borns (66.7%) and was more common in males (66.7%), rural areas (83.3%), early morning hours (33.3%) & term babies (83.3%).SIDS caused 11.4% mortality in normal weight infants and 100% in those with extremely low birth weight. Although the association between SIDS and extremely low birth weight was statistically significant, only one such case was reported, indicating the need for further studies.SIDS cases were often in families with no prior sudden deaths, and all cases involved co-sleeping. Significant associations were found between SIDS and lung hemorrhages. While socioeconomic status showed equal distribution among BPL and APL families, SIDS was significantly associated with certain clinical and demographic factors.

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Original Research Article

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Studies on the Statistical Analysis and Impact of Seasonal Temperature and Relative Humidity Variation on the Development of a Flesh Fly *Sarcophagadux* (Thomson 1869)(Diptera Sarcophagidae)

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Abstract

Background: The fleshfly *Sarcophaga dux* (Diptera;Sarcophagidae) is found in Indian Sub continent is of limited forensic significance as its poorly known larval development relationship with temperature and relative humidity.

Objective: The objective of this study was to determine the effect of the temperature and relative humidity in the larval development of this fly in two seasons, Summer and Rain, so that the results of this study may enabling the forensic use of this fly in the estimation of Post Mortem Interval(PMI).

Material and Method: The present study was carried out in the outer premises of the Regional Forensic Science Laboratory Building, Jagdalpur, Bastardist,Chhattishgarh, India. The fresh meat of male goat was used for rearing of larvae. The effect of temperature and relative humidity on the larval developmental time of this fly in two seasons, Rainy and Summer were studied in normal condition. Statistical analysis of variance was performed and standard significance level of $P<0.05$ was taken as standard.

Results: The results of this study shown that in Rainy season it was completed in 264 h (11 days) when the average temperature ranged from 21.8°C to 24.5°C and the average humidity ranged from 79.5% to 95.5% where as in Summer it was completed in 528 hrs (22 days), when the temperature ranged from 26.5°C to 35.1°C and the humidity ranged from 34% to 67.5%. The P value was found to be $P<<.05$ in Temperature variation; and$P<<0.05$ in Humidity variation in different stages(1st instar larvae, 2nd instar larvae, 3rd instar larvae, Prepupae, Pupae and Adult).

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Conclusion: In the present study we have found that fluctuating temperature and relative humidity of outer condition in two seasons, Rainy and Summer effect the life cycle duration of the fly from the larvi position up to adult eclosion and statistical analysis has proved it to significant rejecting null hypothesis. This data can be further used in the estimation of Post Mortem Interval (PMI) in Homicide and Suspicious cases of both human and wild life poaching death cases.

Key words: Forensic entomology, *Sarcophaga dux* (Thomson ,1869), Temperature, Relative Humidity, Larvae, P value

Introduction

The presence of some species of insects, including their immature stages can provide information about the location, time and condition of cadavers and hence forensic entomologists make use of the same in crime investigations as reported by (Bharti et.al. 2007[1]; Byrd and Castner 2010[2]; Greenberg1991[3]; Goff 2000[4]; Singh and Bharti 1999[5]; Suri Babu 2008[6]). The blow flies are the most important forensic indicators because they are usually the first to colonizethe carcass, often within minutes or even seconds of exposure, the flies were *Calliphoravicina* at constant temperature of 10,12.5,19,22.5^{o}C, *M. scalaris* at 22 and 29^{o}C by Greenberg 1991[3]while impact of place where crime has occurred has a varying temperature which hugely impacts the growth of fly development which is taken in to consideration in this study. The flesh flies belong to the family Sarcophagidae, currently in the world there are 133 genus and 3079 species as reported by Roskov Y et.al 2016[7].

The insects most frequently used to estimate PMI and as toxicological analysis samples belong to the families Calliphoridae (blowflies) and Sarcophagidae (flesh flies). These flies are expert agile flyers that feed on corpses, and are usually the first to arrive to the corpse or death scenario as reported by Goff et. al. 1994[8].Family Sarcophagidae have been found both in Britain and elsewhere, to be present on the body after a few days of decomposition. One of the most significant things aboutthis family is that the flies are viviparous, i.e. they generally lay larvae onthe corpse and not lay eggs as report by Gennard DE 2007[9].

The first insects to arrive under most circumstances are the Calliphoridae (blow flies) and Sarcophagidae (flesh flies). Female files will arrive and begin to explore the potential sites for oviposition or larviposition.Forensic entomologists may have difficulties in estimating PMI when species that are hard to identify are collected, such as Sarcophagidae and Phoridae (3,000 species in the world). The main consequence in this situation is also the lack of development data of some species in these families as reported by Amendt et. al.2010[10].The Indian family of Sarcophagidae consists of 126 species, out of which 89 species are from the genus Sarcophaga which amounts for 70% of the Indian Sarcophagidae family as reported by Chakraborty et.al. 2017[14].

Sarcophagidae are considered to be unimpeded by rain and to fly despite the weather as reported by Erzinçlioglu, 2000[16]. In recent times in India Abd-Algalil et. al.2017[19] have studied on *Chrysomyasaffranea* (Bigot, 1877), effects of variation in temperature and humidity on the different life cycle stages of Calliphoridae fly *Chrysomyasaffranea* (Bigot, 1877), but it has been conducted at laboratory condition, as par usual crime scenes, dead bodies are mainly found in the open sites.So climatic condition with fluctuating temperature and humidity plays an important role as reported in our previous paper, Suri Babu et. al. 2013[15]. we have formulated a pioneer first method in South East Asia for determining post mortem interval (PMI) of dead body lying in open for over 4 days with inclusion of temperature of the given territory of that area of given time period and we developed formulation which gave accurate time of death, in same manner we have reared flies in open taking in account of temperature and relative humidity of the area. We have tried to find out changes in stages of rearing and variation in timingsof rearing stages by the impact of temperature and relative humidity of that area, whether significant variation is found in seasonal variation or not.

Material and Methods

The present study was carried out in the outer premises of the Regional Forensic Science Laboratory Building, Jagdalpur, Bastar dist, Chhattishgarh, India. A detailed study of the pattern of succession of flesh fly was done in Rainy season July 2012 and Summer season June 2012.

The fresh mass of meat of malegoat was transferred to a 500ml plastic container in which mixture of saw dust and soil was placed at the bottom. The mouth of the container was closed with a perforated lid to facilitate air circulation and to prevent newly emerged flies escaping from the container. A Sket© brand Germany made Maxima-Minima thermometer was used for recording of maximum and minimum daily temperature which were later tallied with local weather station data.

The maggots were observed daily and different immature stages and adults were collected and identified with the help of taxonomic keys of White RS, 1923[11], White RS et.al. 1940[12], Smith KGV 1986[13], Chakraborty et.al.2017[14] , Amendt et. al. 2010[10] and further identification wasconformed by the Zoological Survey of India, Kolkata, West Bengal, India.

The flies were identified to be of Order: Diptera; Family: Sarcophagidae; Species: Sarcophaga (Liosarcophaga) dux (Thomson,1869).

The Meteorological data: temperature, rainfall and relative humidity were obtained from The Government Agromet Observatory, Shaheed Gundadhoor College of Agriculture and Research Station, Kumaravand, Jagdalpur-494001,CG,India.

Growth pattern of *Sarcophagadux* reared in season of Rainy and Summer season:

Table 1: Growth pattern of Rearing of *Sarcophaga dux* in Rainy season.

Stage	Length (mm)	Time Spent in Stage(Days)
1st Instar Larvae	5	3 (19/07/12-21/07/12)
2nd Instar Larvae	11	1 (22/07/12)
3rd Instar Larvae	19	1 (23/07/12)
PrePupae	8	1 (24/07/12)
Pupae(P)- Adult emergence(A)	10(P)- 12(A)	5 (25/07/12-29/07/12)

Table 2: Growth pattern of Rearing of *Sarcophaga dux* inSummer season.

Stage	Length (mm)	Time Spent in Stage(Days)
1st Instar Larvae	5	2 (02/06/2012-03/06/12)
2nd Instar Larvae	11	1 (04/06/12)
3rd Instar Larvae	19	3 (05/06/12-07/06/12)
PrePupae	8	3 (08/06/12-10/06/12)
Pupae(P)- Adult emergence(A)	10(P)-12(A)	13 (11/06/12-23/06/12)

Table 3: Photographs of different stage of life cycle of *Sarcophaga dux*: 1st instar larvae, 2nd instar larvae, 3rd instar larvae, Prepupae, Pupae, Adult.

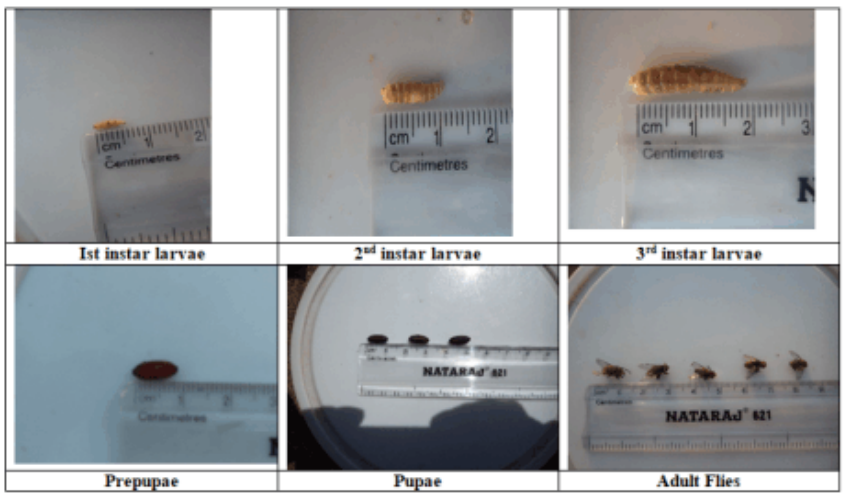

Table 4: Meteorological data of 18/07/12-29/07/12 (Rainy season) and 01/06/12-23/06/12 (Summer season) for Average Temperature, Rainfall and Average Relative humidity.

	Meteorological data of 18th July, 2012-29th July 2012(Rainy)				Meteorological data of 01st June, 2012-23th June 2012(Summer)			
S. No	Date	Avg Temperature	Rainfall	Avg. Humidity	Date	Avg Temperature	Rainfall	Avg Humidity
1	18/07/12	24.6°C	0.0	87%	01/06/12	34°C	0.0	38.5%
2	19/07/12	24.5°C	18.2	91%	02/06/12	33°C	0.0	33%
3	20/07/12	22.5°C	18.8	93.5%	03/06/12	35.1°C	0.0	42.5%
4	21/07/12	22.6°C	20.0	92%	04/06/12	34.3°C	0.0	34%
5	22/07/12	22.3°C	40.2	95.5%	05/06/12	33.9°C	0.0	31.5%
6	23/07/12	21.8°C	17.4	79.5%	06/06/12	34°C	0.0	40.5%
7	24/07/12	24.3°C	1.2	83.5%	07/06/12	32°C	0.0	42%
8	25/07/12	23.3°C	35.2	88%	08/06/12	32.1°C	0.0	35.5%
9	26/07/12	23.6°C	15.8	93%	09/06/12	32.3°C	0.0	41.5%
10	27/07/12	22.3°C	8.0	88.5%	10/06/12	29.8°C	47.4	72.5%
11	28/07/12	22.4°C	4.4	80%	11/06/12	25.8°C	0.0	66.5%
12	29/07/12	24°C	6.8	82.5%	12/06/12	28.8°C	0.0	54%
13					13/06/12	28°C	5.2	56.5%
14					14/06/12	29.3°C	0.0	54.5%
15					15/06/12	29.8°C	0.0	50.5%
16					16/06/12	30.9°C	0.0	54.5%
17					17/06/12	27.8°C	5.2	75%
18					18/06/12	24.8°C	2.0	70%
19					19/06/12	24.95°C	0.0	69.5%
20					20/06/12	25°C	3.2	79.5%
21					21/06/12	24.1°C	7.6	84.5%
22					22/06/12	22.5°C	15.8	89.5%
23					23/06/12	23.3°C	2.8	73.5%

Statistical analysis for Temperature variation in *Sarcophaga dux*rearing in weather condition of Rainy and Summer season:

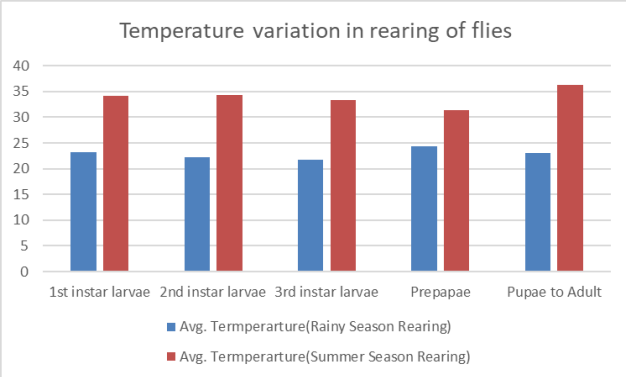

Figure 1: Temperature variation in stages of rearing of *Sarcophaga dux* (Thomson, 1869) in weather condition of Rainy and Summer Season.

Mean of temperature variation in Rainy and Summer season= $X_{msrg}X_{msrg}$ = 22.9 (Rainy season), 33.9(Summer season

Overall mean: $\overline{XX}_{..}$ = 28.4,

X_{ts}= Average temperature at different stages(1st instar, 2nd, 3rd instar, prepupae,P-A) respectively of growth period, $_t$ = temperature and $_s$ = stage No. of observations in average temperature in stages(n) = 5, Sets of data taken (a) = 2, Number of stages data (N) = 10

Table 5: Hypothesis testing for Temperature variation in different stages *Sarcophaga dux* (Thomson, 1869) rearing in weather condition of Rainy and Summer season.

SS_B (between Rainy and Summer season) = n $\sum(X_{msrg}\sum(X_{msrg} - \bar{X}\bar{X}_{..})^2$ = 302.5	df_B= a-1=1	MS_B= SS_B / df_B = 302.5	F_{stat}= MS_B/ MS_E= 149.8 $F_{critical}$=$F_{(dfB,,dfE)}$ = 5.32 So, F_{stat}>$F_{critical}$ Hence, Reject nullhypothesis, significant difference in temperaturevariation indifferent stages of rearing of *Sarcophaga dux*in Rainy and Summer season	The P value=0.00000195, is lessthan 0.05
SS_E(with in Rainy and Summer season/error within)=$\sum(X_{ts} - X_{msrg})^2$ $\sum(X_{ts} - X_{msrg})^2$ With in group variation= 16.23	df_E=N-a=8	MS_E=SS_E/ df_E = 2.02		

Statistical analysis for Humidity variation in *Sarcophaga dux* rearing in weather condition of Rainy and Summer season:

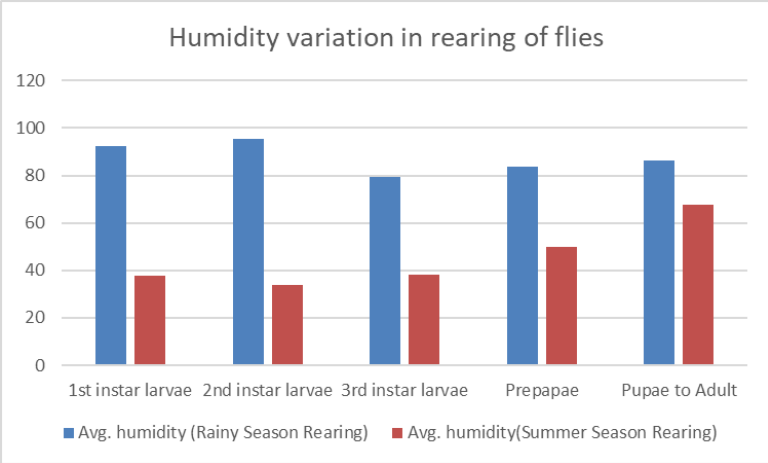

Figure 2: Humidity variation in stages of rearing of Sarcophaga duxin weather condition of Rainy and Summer Season.

Mean of humidity variation in Rainy and Summer season= $X_{msrg}X_{msrg}$ = 87.4(Rainy season), 45.4(Summer season).

Overall mean: $\overline{XX}_{..}$ = 66.4,

X_{ts}= Average humidity at different stages(1st instar, 2nd, 3rd instar, prepupae, P-A) respectively of growth period, $_t$ = temperature and $_s$ = stage.

No. of observations in avg. humidity in stages(n) = 5, Sets of data taken (a) = 2, Number of stages data (N) = 10

Table 6: Hypothesis testing of humidity variation in different stages *Sarcophaga dux* rearing in weather condition ofRainy and Summer season.

SS_B (between Rainy and Summer season) = n - $_{..})^2$ = 4411.9	df_B= a-1 =1	MS_B= SS_B / df_B =4411.9	F_{stat}= MS_B / MS_E = 38.6 $F_{critical}$=$F_{(dfB,,dfE)}$ = 5.32 So, F_{stat}>$F_{critical}$ Hence, Reject nullhypothesis, significant difference in humidity variation indifferent stages of rearing of *Sarcophaga dux* in Rainy and Summer season	The P value=0.000259, is less than 0.05
SS_E (with in Rainy and Summer season /error within)= With in group variation = 913.5	df_E =N-a =8	MS_E=SS_E / df_E = 114.2		

Result

In the variation of temperature of Rainy and Summer season:-The P value was found to be 0.00000195, and P<<.05. In the variation of relative humidity of Rainy and Summer season:-P value was found to be 0.000259, and P<<0.05 indifferent stages(1st instar larvae, 2nd instar larvae, 3rd instar larvae, Prepupae, Pupae-Adult) of *Sarcophaga dux* proving there is a significant difference in of Temperature and Humidity variation in stages of rearing in different seasonal conditions.

Discussion

Mahmood et. al. 201217 have reported abundance of pre-pupae of Calliphorid and Sarcophagid flies preferring a particular pupation was observed against six different pupation substrates. These substrates were commonly found in the vicinity of human habitats. This experiment was designed to trace the forensically important pre-pupae with reasonable accuracy. Variations among the all six pupation substrates were differing significant ($p<0.001$). Significant variations were observed between the batches ($p<0.01$). In our study also Temperature variation and Relative humidity variation in ***Sarcophaga dux*** rearing in weather condition of Rainy and Summer season, Variation was found to be differing significant to be P=0.00000195 (P<<0.05) in Temperature variation and P=0.000259(P<<0.05) in humidity variation in different stages of fly development.

Grassberger et. al. 2002[18] have reported development time from oviposition to adult eclosion was shortest at 35.8ºC and longest at 15.8ºC. In our study we have found the development time from 1st instar larvae to adult fly was shortest at 34.3ºC with 2nd instar larvae of Sarcophaga duxstage taking 24 hrs in Summer season rearing of fly and longest at 36.3ºC with pupae to adult stage of Sarcophaga duxstage taking 312 hrs in Summer season rearing of fly.

Abd-Algalil et. al.201719 have reported the total life cycle duration of *Chrysomyasaffranea* (Bigot, 1877)in Summer was completed in 220 hrs (9.17 days) when the temperature ranged from 30.5°C to 33.2°C and the humidity ranged from 12% to 19%, but in Rainy season it was completed in 259 h (10.79 days) when the temperature ranged from 25.6°C to 28.9°C and the humidity ranged from 50% to 65%. and the shortest life cycle duration was recorded in Summer, then followed by the Rainy season. While in our study the total life cycle duration of *Sarcophaga dux* in Summer was completed in 528 hrs (22 days), when the temperature ranged from 26.5°C to 35.1°C and the humidity ranged from 34% to 67.5%, but in Rainy season it was completed in 264 h (11 days) when the temperature ranged from 21.8°C to 24.5°C and the humidity ranged from 79.5% to 95.5%.The shortest life cycle duration was recorded in Rainy, then followed by the Summer season.

Abd Algalil et. al 201520 have reported that in their study on the developmental duration of *Chrysomyamegacephala* (Diptera: Calliphoridae) the total life cycle duration in Rainy season was completed in 265 h ± 2 h (11.04 days ± 0.08 days) when the temperature ranged between 26°C and 29°C and humidity ranged between 35% and 50%. While in our study the total life cycle duration of *Sarcophaga dux* in Rainy season was completed in 124 h ± 4 h (11.05 days ± 0.06 days) when the temperature ranged between 21.8°C and 24.3°C and humidity ranged between 79.5% and 95.5%.

Warren et. al. 2013[21] compared the immature development of (Diptera: Calliphoridae) *Protophormiaterraenovae* (Robineau-Desvoidy, 1830) at fluctuating temperatures of 4-28 and 9°C to 23°C and at their mean constant temperature 16°C, they reported that the development was fastest at the greater fluctuation and slowest at the constant temperature and showed similar percentages of development time in each stage. They conclude that the fluctuations above the mean enhance the developmental rate relatively more than temperatures below the mean can reduce the developmental rate. In our study in Rainy season, development of Sarcophaga dux at fluctuating temperature of 21.8-24.5ºC and mean temperature of 22.9ºC and in Summerseason, development at fluctuating temperature of 31.4 ºC -34.3ºC and mean temperature of 33.9ºC, The development was fastest in heavy fluctuation of temperature in Rainy season and slowest in less fluctuating temperature in Summer season.

Conclusion

From present study we can conclude that shortest life cycle duration of *Sarcophaga dux* was in Rainy season with moderate temperature and high relative humidity where as in Summer season longest life cycle duration was observed where high temperature and low humidity was noticed. The value of P<<.05 was found Temperature variation; P<<0.05 was found in Humidity variation in different stages(1st instar larvae, 2nd instar larvae, 3rd instar larvae, Prepupae, Pupae-Adult) of this flyproved significant difference lies in variation and hence it rejects null hypothesis proving Temperature and

Relative Humidity do cause significant variation in different stages of fly development, proving vital for the cases of Homicide and Suspicious death cases of both human and wild life poaching indetermination of Post Mortem Interval(PMI) as previously theKulshrestha et. al 2005[22] the rearing of the flies in the actual environmental of crime scene place was not considered, in our study we have statistically proved that environmental variation does play a significant role in the growth pattern of forensic flies, this area of variation in environment need to be expanded as in India there is huge variation in climatic condition in different places a further broad level study needs to be done in this field as it implies a huge factor in determination of Post Mortem Interval in highly decomposed bodies where traditional parameters of determining times since death are not applicable.

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Original Research Article

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Evaluation of Characteristic Findings Suggestive of Manner of Firearm Injury: An Autopsy Based Retrospective Study

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Abstract

Incidence of deaths due to firearm weapons are rising in developing countries. There are only a few studies published on firearm injury in Gujarat. Pattern wise distribution of firearm injury is largely uncovered. This study is on characteristic findings suggestive of manner of firearm injury. Here a retrospective study of15 years is conducted. In this study, young aged males are affected the most as they are socially most active so are having high probability of interpersonal violence. On the spot death of the victim is observed in 85% cases. Rifled firearm is most commonly used. Single shot observed in majority of cases. Homicide is observed more than suicide. Stricter legislation on the ownership and use of firearm weapon is needed. Increase in suicidal pattern in police officials by using firearm weapon is major concern and proper psychological evaluation with mental support will definitely reduce this mortality.

Keywords: Firearm injuries, Rifled firearm, Shotgun firearm, Entry wound, Exit wound, Manner of death.

Introduction

Deaths due to firearm weapons are rising in developing countries. Nowadays Firearm weapons are easily available in large scale in India and other parts of the world. Firearm mostly used for homicidal as well as suicidal purpose because of very easy and quick method of death. [4]

This study represents a pioneering effort in Ahmedabad, Gujarat, focusing on firearm-related fatalities, an area under-researched until now. Our primary aim is to analyze distinct patterns indicative of the nature of firearm injuries. The investigation encompasses a range of socio-demographic factors, the types of firearms involved, temporal distribution of incidents within a day, locations of injuries, number

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of shots fired, firearm range, survival durations, and causes of death. These parameters collectively aim to provide a comprehensive understanding of the circumstances surrounding firearm-related deaths in the Ahmedabad region.

Materials and Method

The present retrospective study was conducted in the Department of Forensic Medicine and Toxicology of the B. J. Medical College, Ahmedabad. Which includes post mortem of firearm injuries conducted under Post mortem room of Civil Hospital, Ahmedabad. 15 years data from 1st January 2009 to 31st December 2023 was collected from post mortem notes of the deceased. During this period, a total of 57,862 post mortem were conducted, out of which 40 cases were of firearm injuries under B.J. Medical college.

This study presents data from a variety of autopsy reports which have been evaluated, focusing on their investigative findings in order to better understand of the characteristics of firearm wounds and the differences between suicidal, homicidal, and accidental fatal gunshot injuries. The data was collected in a proforma prepared for this study purpose. The collected data as analysed using Google form and Google sheet.

Result

Majority of the incidence of firearm deaths were homicidal 24 cases (60%) in nature followed by suicidal 11 cases (27.5%) and accidental 4 cases (10%) deaths, only in one (2.5%) case the manner of death had remained undetermined (Table-1).

Table 1: Manner of incidence and Age and gender wise distribution of firearm injury cases

Age(years)	Gender	Homicide	Suicide	Accident	unknown	Total
0-20	Male	01	01	01	00	03
	Female	01	00	00	00	01
21-40	Male	16	07	01	01	25
	Female	01	00	00	00	01
41-60	Male	04	03	02	00	09
	Female	01	00	00	00	01
>61	Male	00	00	00	00	00
	Female	00	00	00	00	00
Total		24	11	04	01	40

Table-1: Showing distribution of cases according to manner of incidence and age and gender.

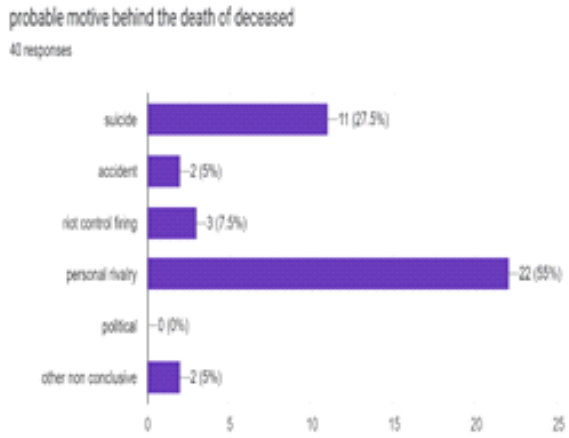

Fig. 1: Showing distribution of cases according to motive behind the death.

Most commonly affected gender was male with 37 (92.5%) cases as they are socially most active so are having high probability of interpersonal violence. While in female 3 (7.5%) cases of homicide were observed. The most commonly involved age group was 21-40 years with 26 (65%) cases, while least commonly involved age group was more than 60 years with zero case. In 24 cases (60%) the place was outdoor, 10 cases (25%) home and 6 cases (15%) work place. More cases occurred in daylight [30 (75%) cases] than in night [9 (22.5%) cases] and one case (2.5%) had no history.

Head > neck region were the most common target in suicidal case (100%), while in homicidal cases chest> abdomen> head region were more involved (graph no.5). Overall brain was most commonly involved vital organ, while heart is least commonly involved

organ. Brain is involved in 100% cases of suicide. While homicide involves any vital organ. Here, in 1 accidental case lung was involved (graph no.3).

All suicidal, accidental and 79% of homicidal cases died on the spot. Rest one victim died within 12 hours and two victims survived more than 11 days. Single firearm entry wound was found in 34 cases of which all 11 cases were of suicide. In 23 cases no exit wound were present, in which 18 cases were of homicide. Single bullet was recovered from 20cases, out of which 13 cases were of homicide and 5 recovered from suicide. In 81.81% cases of all suicidal cases, the direction of projectile was upward, backward, right to left, while in majority of homicidal cases the direction was downward, backward, right to left observed.

Observation of suicidal firearm wounds suggests most commonly involved Site – temporal region> undersurface of chin> Forehead. The direction of injury is upward, backward and towards right to left in all suicidal cases (chart no.2).Gunshot residue are present over hands, clothes and skin involved in firearm injury case. There is single shot observed in all suicidal cases. All the 65% of contact shots were showing some characteristics of entry wound i.e., muzzle imprint, abrasion collar, grease collar, singing of hair, burning, tract of the wound shows blackening, tattooing and cherry red color blood (graph no.4). all the characteristics of entry wound are present in 2.5% cases of suicide, 2.5% cases of homicide and 0% cases of accidental cases. 2 cases show burst head effect. The reason behind suicide was depression due to financial loss, failure of love affair etc (graph no.1). In present study, characteristics of entry wound were seen in suicide >homicide >accident order. With help of above-mentioned information, we can state that, the range of firearm weapon is inversely proportion to the characteristics of the entry wound.

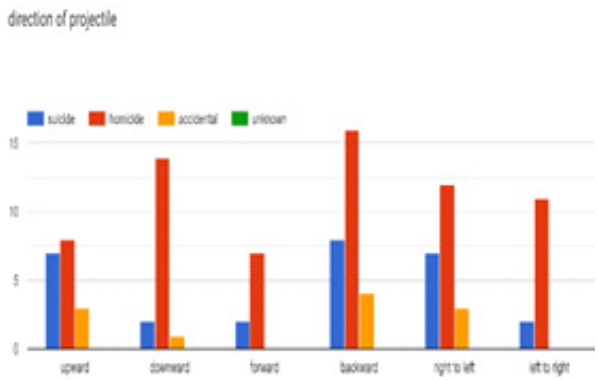

Fig. 2: Showing distribution of cases according to the direction of projectile.

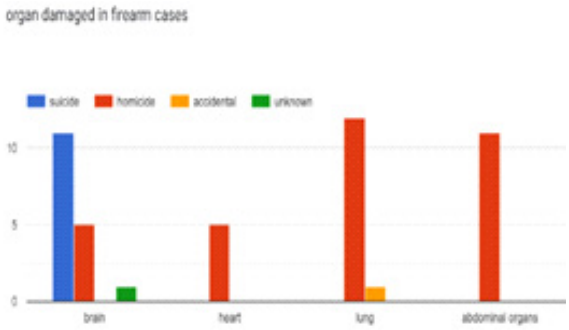

Fig. 3: Showing distribution of cases according to the organ damaged.

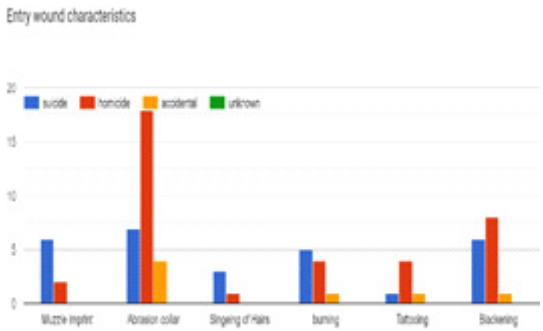

Fig. 4: Showing distribution of cases according to the entry wound characteristics.

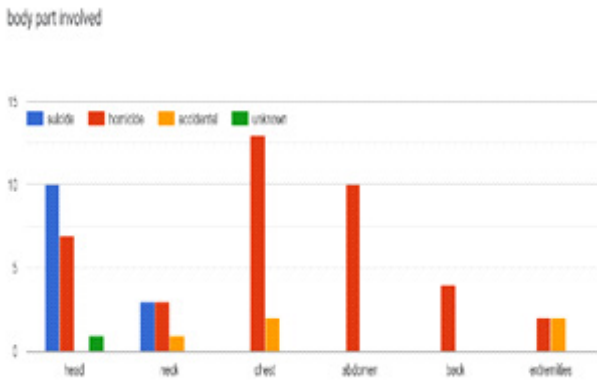

Fig. 5: Showing distribution of cases according to the body part involved.

In present study, 9 cases show presence of Gun Shot Residues (GSR) in cotton rub from hands out of which all were suicidal cases. Not a single case observed in homicidal case. Gun Shot Residues on clothes are present in 8 cases, and all are of homicidal cases. The Gun Shot Residues on skin of entry wound was present in 20 cases. Here the major lacuna was unavailability of reports because of that it was difficult to analyze the actual result regarding GSR.

Discussion

Majority of the incidence of firearm deaths were homicidal 24 cases (60%) in nature followed by suicidal 11 cases (27.5%) and accidental 4 cases (10%) deaths, only in one (2.5%) case the manner of death remained undetermined. Homicidal intent was predominant in most other studies [Pargi S.L. et al.[4] (78.26%), Sachan et al.[7] (92%), Kumar et al.[5] (96%), Kumari et al.[6] (88.34%)]. The preponderance of homicide gun-shot injuries is explainable as these deadly weapons are generally used in planned manner or so impulsively in planned assault. Accidental injuries with firearms are also not uncommon as users are prone to such episodes while cleaning, maintenance or erratic handling of loaded guns. Accidental injuries seen in present study in 10% cases, in Pargi et al.[4] study it was quite higher (16.52%), while in Kumar et al.[5] (1.73%) and Kumari et al.[6] it was 6.67%.

In present study, all age groups are included from zero to >60 years. The maximum number of cases are from 21-40 years of age group with 26 cases (65%). This group is more social and more active group in society. This type of findings is similar with Pargi S.L. et al.[4], Sachan R. et al.[7] and Kumar K et al.[5], where high incidence occurs between 21-40 years of age group. The result of our study is slightly contrast with study of Kumari et al.[6], who reported maximum number of cases in 11-20 years followed by 21-30 years. This variation is due to minor cultural and periodic differences. Moreover, the age group of 11-20 years is quite young for use of such deadly weapons and thus, this variation does not have much significance. The least affected age group in present study is more than 60 years.

In present study, in 91.66% cases of homicide (22 cases) the motive was personal rivalry. 100% suicidal cases are due to depression because of financial loss, failure in love, etc. in our study, 60% death occur in outdoors, out of which 79.16% are homicide. 25% deaths(10 cases) occur at home, out of which 60% (6 cases)are suicidal cases. Only 6 cases (15%)occur at workplace out of which 4 cases were of suicide, 1 of homicide and 1 of accidental manner. While comparing with other studies, our results are similar with study of Pargi S.L. et al.[4] and Kumar K et al.[5] where 79% and 66.95% incidence occur in outdoors and 21% and 33.05% in indoor places respectively.

It was observed that in our present study 75% cases occurred in daytime and 25% cases were in night time. The results are similar toPargi S.L. et al.[4]in which 90.43% cases occurred in daytime and 8.70% cases in night-time. In present study night the less numbers of gun-shot injuries (25%) witnessed which is in contrast to the findings of Kumari et al.[6] in which >50% firearm injuries occurred in night and Kumar et al.[5] (47.82% daytime and 51.31% in night).

Our study shows most common involvement of head (45%) followed by chest (37.5%) followed by abdomen (25%). Back and extremities shows 10% involvement of each. These result bears variation with those of Pargi et al.[4] [chest(31.3%)>abdomen (18.26%) head (14.75%)], Kumariet al.[6] [abdomen(30.9%)>chest (21%) head(16%)]. In Pargi et al.[4]'s study 33.04% cases of gun-shot wounds were found on periphery and neck was the least affected region (2.61%). While in Sachan et al.[7] where the most common site was abdomen followed by head and neck.

Conclusion

In present study, it was observed that in suicide male gender of police occupation involved the most, and site were temporal region with pistol, undersurface of chin and Forehead with rifle. All cases of suicide were of contact shot. The direction of bullet was upwards, backwards. Single entry was observed in all suicidal cases. Skin, clothes and hand shows presence of gunshot residues. In homicidal cases, usually male involved regardless of his profession. The site of firearm wound; range of projectile were not specific. In majority of homicidal cases the direction is observed was downward, backwards and right to left. Hands of victim never display gunshot residue. In accidental cases, male involves the most as they are likely to be familiar with guns. The distance is up to close range. The weapon is present at the crime scene. Almost all cases of suicide, homicide and accident show the characteristics of firearm entry wound. More findings are seen in cases of suicide. Cases of homicide and accident shows more or less findings depending on their range in distance.

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Original Research Article

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Pattern of Drowning among Autopsies Conducted at Baroda Medical College and S.S.G Hospital

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Abstract

Drowning kills at least 3,72,000 people every year and is the 3rd leading cause of unintentional deaths. In addition to the human tragedy, drowning represents a huge economic problem with direct and indirect costs, including many Disability-Adjusted Life Years. In India, there is limited knowledge about the epidemiology of drowning. The objective of the study was to study the incidence, manner and epidemiology of deaths due to drowning in and around Vadodara region. The present study was conducted from May 2022 to April 2023 in Government Medical College, Baroda on 82 cases to study the various epidemiological parameters of drowning. In this study period, 1989 cases of post-mortem examination were done out of which 82 cases were of drowning deaths. A maximum number of cases were seen in the age group of 21–30 years with 43% cases of males, dominating the study population. 62% of deaths were accidental in nature and occurred during the rainy season. The most common place of occurrence of drowning was river (38%) followed by water canal (31%). Soddening of hands and feet was the most common external feature of drowning followed by the presence of froth at mouth and nostril. Drowning is a most ignored public hazard worldwide with serious implications for the society. Public awareness regarding safety measures and drowning prevention strategies suitable to the needs of geographical region should be adapted.

Keywords: Drowning, Manner of death, Site of drowning.

Introduction

One of the most neglected public health issues concerning the world today is drowning. Drowning kills at least 3,72,000 people worldwide every year and is the 3rd leading cause of accidental drowning deaths.[1] Conceptually, "drowning" is a complex and multifaceted phenomenon, characterized as a chain of events.[2] Drowning is "The process of experiencing respiratory impairment from immersion or submersion in liquid".[3]

Diagnosing drowning remains one of the most challenging tasks in forensic medicine, as highlighted

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in the literature. External examinations and autopsy findings often lack specificity in many cases, while laboratory investigations can be inconclusive.

Drowning as the cause of death is determined on the basis of external signs, internal signs, biochemical tests for drowning and analysis of diatomaceous material (Diatom test) by the autopsy surgeon. External signs of drowning can vary depending on several factors, and it is important to remember that none of them are considered pathognomonic for drowning.

In a vast country like India, characterized by numerous water bodies and a lengthy coastline, drowning deaths are a persistent concern. The frequent occurrence of floods across different regions and heavy monsoon rains significantly contribute to these fatalities.

Methods

The present study was a prospective study, conducted for 1 year during May 2022 to April 2023. During the study period, a total of 1938 medico-legal autopsies were performed at the Mortuary of the Department of Forensic Medicine, Baroda Medical College. Of these, 82 were deaths caused by drowning which include in our study. All the dead bodies recovered from different sources of submersion were included in this study.

Detailed history related to place of occurrence, incident, type of water body, and other relevant findings were obtained from police and relatives while receiving inquest papers. Details like age, sex, month, time of occurrence, occupation, education, religion, marital status, cause of death, manner of death etc were collected and filled in a proforma. It was then interpreted statistically with tables and bar diagrams.

During postmortem examination condition of clothing, skin changes, examination of natural orifices, injuries on body, and cadaveric spasm were observed, and all the cavities were examined.

In all cases, diatoms were examined with standard protocol in tissues and samples of water collected from place of death. In this study, the term drowning refers to immediate and delayed immersion deaths.

Results

Incidence of drowning is seen in all age groups; majority of cases were in 21–30-years age group (43%) followed by 31–40 years age group (23%). In the present study, 63.41% victims were males and 36.58% victims were females (Table 1). Of the 82 drowning deaths during the study period, 51cases (62%) were accidental, and 31 cases (38%) were suicidal deaths (table.5). Among external features of drowning, soddening (98%) was the most prominent feature, followed by froth at mouth and nostril (84%) and bluish fingernails and lips (77%) (Table 2). The presence of water in stomach (98%) was the predominant internal finding followed by heavy, voluminous, oedematous, and congested lungs (96%) and froth in trachea (53%) (Table 3). Most of the victims were retrieved from rivers (38%) followed by water canal (31%) (Table.6). Month of August accounting for 23 deaths (29%) was the time of majority of drowning deaths followed by July with17 deaths (23%) and lastly June with 12 deaths (17%) (Table 4). Majority of the victims were labourers with 52 cases (63%) followed by student with18cases (31%) and lastly housewife with 8cases (10%) (Table 7).

Table 1: Case distribution by age wise

Age (years)	Male (%)	Female (%)	Total (%)
0-10	1(1.21)	1(1.21)	2(2.42)
11-20	5(6.09)	3(3.06)	8(9.15)
21-30	22(26.82)	13(15.85)	35(42.68)
31-40	12(14.63)	7(8.53)	19(23.17)
41-50	5(6.09)	3(3.06)	8(9.75)
51-60	3(3.06)	1(1.21)	4(4.87)
61-70	2(2.40)	1(1.21)	3(3.61)
>70	2(2.40)	1(1.21)	3(3.61)
Total	52(63.41)	30(36.58)	82(100)

Table 2: Distribution of external features of drowning

Feature	Case	Percentage
Cutis anserine	14	17
Froth at mouth and nostril	69	84
Soddening	80	98
Degloving	60	73
Congested conjunctiva	56	68
Bluish fingernails and lips	63	77
Animal bites and decomposition	13	16

Table 3: Distribution of internal features of drowning

Feature	Case	Percentage
Froth in trachea	52	63
Mud in trachea	49	60
Froth in larynx	43	52
Presence of voluminous, oedematous, and congested lungs with c/s showing copious frothy fluid	79	96
Emphysema aquosum	32	39
Rib marking on lungs	56	68
Paltauf'shemorrhages	68	83
Presence of water in stomach	80	98

Table 4: distribution of case by month wise.

Month	Cases	Percentage
May	7	6
June	12	15
July	17	22
August	23	29
September	7	9
November	5	6
December	4	5
January	3	4
February	2	2
March	1	1
April	1	1
Total	82	100

Table 5: Distribution of case by manner of death.

Manner of death	Cases	Percentage
Accidental	51	62
Suicidal	31	38
Total	82	100

Table 6: Distribution of cases according to place of drowning

Place of drowning	Case	Percentage
Well	17	21
River	31	38
Water canal	26	31
Pond	8	10
Total	82	100

Table 7: Distribution of case according to occupation

Occupation	Case	Percentage
Labourer	52	63
Student	18	31
House wife	8	10
Self employed	2	2
Farmer	1	1
Not known	1	1
Total	82	100

Discussion

The findings in autopsy among drowning cases are usually characteristic, supportive, and is not diagnostic in multiple cases. The mechanism of death in drowning is quite complicated with the involvement of asphyxia and filling of the airways with fluid along with effects at hydrostatic and osmotic level. Males dominated the study with 52 cases when compared with 30 cases of females. Similar results were found in studies by Kanchan et al[4], Chaudhary et al[5], Shetty and Shetty.[6] Male predominance is probably multifactorial as men have exposure to activities where submersion is possible. Maximum cases of drowning were seen in the age group of 21–30 years (63%,) followed by 31–40 years age group. Similar results were seen in studies by Shetty and Shetty[6], Sheikhazadi and Ghadyani.[7]Probable reason for this preponderance of 21–30-year age group is due to carelessness, adventurous nature, and intoxication, whereas swimming or during recreational activities in or around water source. Drowning in 31–40 years age group may be due to familial and financial problems and not finding any solutions to them. Contrasting results were found in the study conducted by Selvaraj and Rama.[8] Maximum cases of death were accidental 51 cases (62%) followed by suicidal 31cases (38%). Similar results were seen in studies by Uppu et al[9], Kumar et al[10] and Venkatesulu et al.[14] The majority of drowning victims were retrieved from rivers 31 cases (38%), followed water canals 26 (31%). This can be attributed to the presence of river in the vicinity of the city and people entering river for recreation and during religious festivals. Similar findings were noted in the study by Selvaraj and Rama[8] and contrasting findings were noted in studies by Fralick et al[11]and Rao et al.[12] Soddening of hands and feet was the major external finding in our

study in 80cases (98%), followed by froth at mouth and nostril in69 cases (84%). The presence of water in stomach was the prominent finding in 80 cases (98%), followed by the presence of heavy and voluminous lungs in79 cases (96%) and froth in trachea in 52 cases (63%). Similar findings were noted in the study of Kumar et al.[10] Maximum cases of drowning deaths occurred in the month of August with23 cases (29%), followed July with 17cases (22%). The findings are almost similar to the studies conducted by Phad and Dhawane[13] and Venkatesulu et al.[14] Most of the deaths occurred in rainy season. Most of the victims were labourers[52 cases(63%)] followed by student[18 (31%)]. This is in contrast to the study conducted by Phad and Dhawane[13] and Venkatesulu et al.[14]Where most common victims of drowning deaths were the students, but in our study, labourers had higher preponderance. This could be attributed to the fact that most of them were daily wage labourers and lack of day-to-day work leads to financial stress on them.

Conclusion

The present study demonstrates the magnitude of drowning deaths and the threat it poses to the public health systems. Young adults are more prone to drowning deaths. This highlights the need for accurately assessing local data to effectively target at-risk populations. Drowning prevention is of paramount importance and is the ultimate motivation for understanding drowning .Greater emphasis on the training of the general populace in measures to be taken in such a situation is required as lifesaving measures like Cardio-Pulmonary Resuscitation can determine whether the victim survives to reach medical treatment or succumbs prior to itIt is preventable but neglected relative to its impact on families, communities and livelihoods. Most of them died by accidents or by committing suicide which denotes the lack of safety measures in the canals/ water bodies. This can be rectified if people are employed in the canals/surrounding water bodies with watchers and improve safety by committing rescue teams after identifying the places with high activity and save those victims.

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Original Research Article

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Pattern of Injuries in Driver and Pillion Rider in Fatal Cases of Motorised Two Wheeler Accidents

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Abstract

Background: Road traffic injuries are the major health problems and leading cause of death and injury around the world. This study was conducted in order to observe the pattern of external injuries and internal injuries. In many set ups there may not be adequate facilities for investigations like imaging. If it is possible to know the common patterns in external and internal injuries it would be possible to give appropriate care and prioritise the treatment.

Methods: An autopsy based prospective study was conducted during the period 2011 to 2013 in the Department of Forensic Medicine after obtaining ethical clearance The pattern of external and visceral injuries in cases of motorised two wheeler accidents were observed and documented.

Conclusion: Out of 37 cases examined at autopsy Among external injuries Abrasions are commonly seen involving the whole body.

Among Visceral injuries Contusions are seen more in Lungs followed by Kidney Spleen, Heart and Liver.Among laceration Liver has the most followed by lung and Spleen.

Key words: two wheeler, accidents, external, visceral injuries

Introduction

Road traffic injuries are one of the major health problems and leading cause of death and injury around the world.[1] This study was conducted in order to observe the pattern of external injuries and internal injuries. The pattern of head injury has been studied and published earlier. However this study also tells regarding the external as well as internal findings in the whole body in cases of motorised two wheeler accidents. It also gives details regarding the patterns in various months and days.In manyhospital set ups there may not be adequate facilities for investigations like imaging. If it is possible to know the common patterns in external and internal injuries it would be possible to give appropriate care and prioritise the

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treatment. Knowing the pattern of the injurysustained in the driver and the pillion rider of motorized two wheelers fatalities help in reconstructing injuries especially in hit and run cases. Knowing the risk factors and contributing factors, helps to develop safety measures since they are preventable to some extent if properly implemented. The study can be extrapolated to learn about the internal findings based on the pattern of external injuries. This can help in triaging cases and also perform the investigations and procedures which can help to save the life of the persons involved.

Materials and Methods

The study was a prospective cross sectional study on the cases autopsied during the period November2011 to June 2013. It was conducted in the Department of Forensic Medicine and Toxicology, Vydehi Institute of Medical sciences and Research Center, after obtaining ethical clearance from the Institutional Ethics Committee of Vydehi Institute of Medical Sciences and Research Centre, Bangalore 24-10-2011 with reference number EC/Reg No. ECR/747/Inst/KA/2011 The sample size was calculated based on similar studies conducted in the past

The data was anonymised. The inclusion criteria was all fatalities due to motorised two-wheeled vehicular accidents, The exclusion criteria was all fatalities in which information on nature of vehicle was not available

Results and Discussion

Two wheeler accidents showed 31% of the total no of Road traffic accidents in Whitefield areaof Bangalore, India.(37 cases out of 84 autopsies)

Table 1: showing the distribution of external injuries on the body

	Abrasion	%	Contusion	%	Laceration	%	Others	%
Head and neck	17	45.95	10	27.03	11	29.73	12	32.43
Upper limbs	24	64.86	13	34.14	7	18.92	7	18.92
Chest	15	40.54	6	16.22	0	0	1	2.70
Abdomen	9	24.32	7	18.92	4	19.81	1	2.70
Lower limbs	18	48.64	7	18.92	8	21.62	1	2.70
Total number of cases	37							

Table 2: Combination of external injuries

	Abrasion	%	Contusion	%	Laceration	%
Head -Chest	27	72.97	17	45.95	12	32.43
Head- Abdomen	21	56.76	13	35.14	15	40.54
Head -Limbs	11	29.73	6	16.22	21	56.76
Chest-Abdomen	17	45.95	11	29.73	3	8.11
Chest - Limbs	26	70.27	18	48.65	12	32.43
Abdomen- Limbs	26	70.27	18	48.65	12	32.43
Combination	27	72.97	18	48.65	21	67.76
Total no of cases	37					

Table 3: Showing injuries to visceral organs

	Contusion	%	Laceration	%	Others	%
Heart	1	2.70	0	0	2	5.41
Lungs	18	48.64	5	13.51	5	13.51
Spleen	3	8.11	3	8.11	0	0
Kidney	5	13.51	0	0	3	8.11
Liver	1	2.70	9	54.32	0	0
Total no of cases	37					

Table 4: Showing amount of blood collection in pleural and peritoneal cavities

	Pleural cavity	Peritoneal cavity
0-500ml	13	2
500-1000ml	5	5
>1000ml	3	3
Total no of cases	37	

Table 5: Showing pattern of external limb injuries

	Abrasion	%	Contusion	%	Laceration		Others	
Upper Limbs	23	62.16	13	35.14	7	18.92	5	13.51
Lower Limbs	17	45.95	8	21.62	9	24.32	3	8.11
Total no of cases	37							

Table 6: showing pattern of fractures of skeletal bones

	Skull & facial bones	%	Upper limbs	%	Ribs and Sternum	%	Vertebra		Pelvis		Lower limbs	
Drivers	22	59.46	6	16.22	19	51.35	7	18.92	7	18.92	11	29.73
Pillion riders	4	10.81	0	0	5	13.51	2	5.41	1	2.70	1	2.70
Total no of cases	37											

Table 7: showing types of skull fractures

	Fissured/ linear	%	Comminuted	%	Depressed	%	Diastatic/ Sutural	%	Hinge	%
Driver	14	37.84	6	16.22	2	5.41	3	8.11	5	13.51
Pillion rider	2	5.41	1	2.70	1	2.70	0	0	2	5.41
Total no of cases	37									

Table 8: Showing pattern of Brain injuries

	EDH	%	SDH	%	SAH	%	SDH+SAH	%	Others/ IVH	
Driver	0	0	3	8.11	4	10.81	10	27.03	4	10.81
Pillion rider	0	0	1	2.70	2	5.41	1	2.70	0	0
Total no of cases										

Table 9: Showing pattern of brain injuries

	Contusion	%	Laceration	%	Edematous	%	Drained out	%
Driver	5	13.51	4	10.81	3	8.11	4	10.81
Pillion rider	2	5.41	1	2.70	1	2.70	0	0
Total number of cases	37							

Most common type of the external injury noticed were Abrasions which were in the upper limbs followed by contusions. And contusions were also more in upper limbs. This in turn is followed by lacerations which involved head and neck and finally by limb and abdominal injuries.

On considering internal injuries in both driver and pillion rider base of the skull fracture is most commonly noticed and temporal bone is most commonly involved in fractures followed, parietal bones and occipital bone. Next common fracture was noticed in ribs and sternum followed by lower limb bones and pelvic bone. On considering the type of fractures to the skull bone fractures, a fissure fracture was most. Injuries to Kidneys, Spleen, Heart and Liver were seen in that order.

Among Lacerations that of Liver was the most common followed by of Spleen and then of Lungs. Type of Intracranial Haemorrhage most commonly noticed was SAH followed by SDH. Among injuries to the brain contusion was commonly noticed followed by Laceration. Severe Brain Trauma with part or most of it fallen out or drained out in few cases were there.

In the current study cause of death most commonly noticed was Shock and Hemorrhage, next common being Blunt Injury. The most common areas of involvement were Head and Neck followed by Chest and Abdomen

Discussion

According to WHO[1] yearly nearly 1.19 million people dieas a result of road traffic accidents. According to Saukko and Knight[2], the extent of an injury sustained in a road crash is directly proportional to the degree of acceleration or deceleration to which the occupant of the vehicle is subjected. A fracture of the skull with associated brain injury is the most common cause of death but multiple injuries constitute a typical feature of fatal motor cycle accident.

Zettas et al [3]in their article describes the term 'motorcycle radius' as they found that severely comminuted intra articular fractures of the distaltibia and radius were numerous. Many studies showthat head injury as the commonest cause of death[4,5] with lower limb injuries being the most common injury.[6,7,8].

In a study during one year period of medico legal autopsies conducted on 950 cases of fatal road traffic accidents at the mortuary of SRN Hospital, MLN Medical College, Allahabad by Kual et al .[9] Mostly lowerextremities 27.39% and pelvis 25.99% received the primary impacts; the head and neck 55.62% the secondary impacts, while secondary injuries were mostly located in the lower extremities 28.38%. Largest number of injuries was recorded in lower extremities 804 number, followed by head & neck 748 numbers. According to Shetty et al [10]Externalthoracic injuries were more common than internal thoracic injuries in the thoracic region. In the abdominal region, internal injuries were more common than external injuries. In a study conducted in Gwahati[11]skull fracture was present in 22(64%) pillion riders and in only 16(38%) in riders. Rib fractures were seen in 33.3% of riders and 17.64% of pillionriders. Laceration to the brain was seen in 16(38%) riders and 18(52.94%) pillion riders. Laceration to the liver and spleen constituted 19% each in riders while it was 14.7% and17.6% respectively in pillion riders. Laceration of the heart was seen in 3 riders (7.14%)and 2 pillion riders (4.76%). In internal injuries lungs (61%) and kidneys (23%) were the most commonly involved organs in the thoracic and abdominal regions respectively.

Conclusion and Acknowledgement

This study shows the distribution of injuries to the various parts of the body. As described head injury forms a major cause of death and injuries to extremities are also common. This can help in planning the policies for protective gears. Strict traffic rules with respect to road safety and safety training and education to the public is important to reduce the burden of complications caused by the same.

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Original Research Article

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Common Contaminants of Blood Group Factors and its Effect on Blood Groups in Blood Samples, Collected at Scene of Crime

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Abstract

For detection of crime in Forensic medicine blood group studies& its application plays an important role. The study of blood grouping gives important information regarding identification and details of Crime Investigation. The most common trace evidence is blood which is obtained from the crime scene. Blood grouping & typing can point to a group of people that have the same blood type rather than pointing particular person. When blood is properly collected and preserved, blood as an evidence can establish a strong link between a criminal and the criminal act. We can trust the blood grouping of blood stains in detection of crime. Randomly A, B, AB, Rh positive blood samples were taken in duplicates and rusted pins, dust particles, detergent, staphylococci are added to it respectively. The common contaminants in blood stains are dust, rust, bacteria and detergent. So an effect of these on blood groups was studied in detail.

Keywords: medico-legal ground, Blood groups factors, contaminants, trace evidences,

Introduction

Blood is considered to be the most common trace evidence obtained from the scene of crime. Blood grouping reveals vital information regarding identification, in relation to Crime Investigation. Blood is considered to be the most common trace evidence obtained from the scene of crime.[[3].] In addition to the ABO group antigens, there is another blood group antigen located on red blood cell surfaces known as the Rhesus factor or Rh factor, this antigen may be present or absent from red blood cell[1].Blood stain collected from scene of crime and victim and suspect can relate the crime with weapon of offence, place of occurrence and also the criminal.

The blood is usually found to be contaminated with i) dust ii) rust on steel or iron weapon iii) bacteria iv) detergent (when stains in clothing are washed with detergent powder). Also stored blood contaminated may also yield erroneous results with passage of time. These results will be definitely of value in medico legal cases [3].

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Aims and objectives

We tried to observe the fact that whether contamination of common contaminants may cause any effect, on detection of blood group during passage of time, and reliability of such tests. Such study was conducted by Prabhas Chandra Chakraborty*, Saurabh Chattopadhyay**Professor[] Shiv Ranian Kumar[1] [7]. As per their opinion rust did not show any effect on blood group factors and hence recovery of the weapon of offence for blood stain has more value than stains collected from old washed wearing apparels or the soil. our study showed it can be considered with caution

Material and Methods

This study was done in the Department of forensic medicine and toxicology, Mahavir institute of medical college Vikarabad. Randomly 5 ml of blood sample of different blood groups were collected from blood bank. attached tothe hospital of Mahavir Medical collegeVikarabad. In sterile vacutainers, A, B, AB, O and Rh positives blood samples were taken in 6 duplicates. (blood bank permission was taken on 27 feb2024. IEC/proposal/2024/127/Feb/2024).

The blood samples of A, B, AB, Rh positive were taken randomly in duplicates. Controls: One tube was kept as control in refrigerator at 4-8 ˚C and second tube at room temperature. and rusted pins, dust particles, detergent, staphylococci bacteria were added to remaining tubes respectively. All the tubes were kept at room temperature for 20 days. except the controls., Grouping was done on first day and results were noted. Again on regular intervals on 5th day, 10th and 17th and 20th day, blood grouping was done and results were noted.

Observations

The control sample and the test sample marked rust retained agglutonogenic activity even after 3 weeks where as the other test samples showed negative results by the 17th day. The samples stored at room temperature and the one contaminated with staphylococcus aurous are affected earlier.

On 10th day A and B groups showed negative results in the tubes marked dust, while Rh was weekly positive. The reverse was observed in tube marked detergent.

Results

Blood samples in dust after 10 days incubation had changed from A, B, AB to O blood group with Rh negativity.

Blood samples in rust had retained with original ABO group but Rh positive were converted to Rh negative.

Detergent tubes had also changed Rh positive to negative retaining original ABO.

There was no change in either ABO or Rh blood groups in tubes with staphylococcal bacteria.

So there were lots of changes in blood groups after 10 days of incubation in all tubes with contamination.

Table 1: Results of Blood Grouping of various samples with passage of time: Observed changes.

Day	Group	Control	Room temperature	Rust	Dust	Bacteria	Detergent
Day-1	A	+	+	+	+	+	+
	B	+	+	+	+	+	+
	Rh	+	+	+	+	+	+
Day-5	A	+	Weakly+	+	+	+	+
	B	+	Weakly+	+	+	+	+
	Rh	+	Weakly+	+	+	+	+
Day-10	A	+	-	+	-	-	+
	B	+	-	+	-	-	+
	Rh	+	-	+	Weakly+	-	-
Day17 and+	A	+	-	+	-	-	-
	B	+	-	+	-	-	-
	Rh	+	-	+	-	-	-

Discussion

In the present study the sample stored at room temperature was weekly positive at day 4 and the earliest to show negative as rapid decomposition of blood occurred.

Enticknap [1] states that the standard techniques give valid results for grouping of ABO and Rh group from red cells extracted from cadavers many hours after death.

Our study supports the findings of Gettler and Grammar [2] who strongly advised against the use of blood grouping of decomposed and contaminated stains as the results may be in conclusive.

Rust (ferric oxide) did not show any effect on the RBC or the agglutonogenic capacity and grouping could be satisfactory done up to third week.

Here also the dust contaminated sample gave negative result for A and B on the 10th day where as the Rh factor showed negative result much later on 17th day.

In the sample marked detergent the Rh was negative at 10 today while A and B group showed positive result. Subsequently all the results were negative by 17th day.

Conclusion

Stains contaminated with common agents like dust, rust, bacteria and detergent give inconclusive results by mixed agglutination method with passage of time. The results may be accepted with caution as the opinion might be medico legally significant.

Blood grouping though is an important identity in identifying crime it is not reliable if it is contaminated with dust detergent test etc

Older stains in crime will be usually contaminated so have to be very careful while identifying blood groups in case of medical legal issues

Ethical clearance: taken

Conflict of interest: None

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