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Contents:

- From Editor's Desk 2
- **Guest Editorial**
  - Quality of Medical Education: Then & Now 3
- **Originals and papers**
  - Profile of road traffic accidents & head injury in Jaipur (Rajasthan)
    Akhilesh Pathak, N. L. Desania and Rajesh Verma 6
  - Thermal burn: An epidemiological prospective study
    Usama B. Ghaffar, Munnawar Husain and Shammem J. Rizvi 10
  - Determination of Malathion in blood and urine using Thin-Layer Chromatography
    A.K. Jaiswal , Ashmeet Kaur , T. Millo and Adarsh Kumar 15
- **Case Reports**
  - Detection of Ranitidine by Thin Layer Chromatography- A case study
    V. Dhingra, U, Mishra and Jyotsana Pandey 22
  - Lizard bite in Indian child : A case report
    Amar Taksande, Arvind Kumar and Krishna Vilhekar 24
- **Review Articles**
  - Occupational hazard with "PRIONS"- in Autopsy workers 26
    S. Suguna Hemachander, Shaikh Khaja and Suma Kaza
  - Neurological manifestations in Organophosphorous toxicity
    Vikram Palimar and Arun M. 29
  - Virtopsy: One step forward in the field of Forensic Medicine - A Review
    A.J. Patowary 32
- **Supplements**
  - Salient Features: Draft- Restructured Medico legal Curriculum 37
  - Andhra Pradesh Ordinance Against the Violence on Doctors and Medical Establishments 54
  - Guideline to Authors/Contributors 57

Journal of Indian Academy of Forensic Medicine

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From Editor's Desk

It is my great privilege to present the first issue of thirtieth volume of our renowned journal so as to continue the march of academic pursuit initiated by the pillars of our prestigious academy, for the benefit of one and all connected directly or indirectly with the Forensic Medicine and Science Community at large.

I feel greatly obliged to the learned members of "Peer Review Group" and "Advisory Board" who have extended their willingness to guide me to perform the onerous role of Editor of the journal. While conveying my sincere thanks for the same, I assure all concerned that I will strive hard to deserve the confidence reposed in me for the uphill task**.**

I express my gratitude to Dr. (Flt. LT.) M. A. Balasubramanya, Secretary of Swami Vivekananda Youth Movement who was kind enough to forward the copy of " Draft medico legal Curriculum".

It is my humble submission to all the members that they need not hesitate to point out any flaw or deficiency in my endeavor to bring out the journal at periodical intervals in its appropriate form with interesting contents. I assure you that any criticism, comments or suggestions will by accepted by me in right spirit and will try my best to present the journal in qualitative, meaningful and purposeful form and contents.

Ending with the hope that our collective efforts will definitely help in sustaining a good quality of the journal in the upcoming issues.

C. B. Jani

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Originals and Papers

Profile of Road Traffic Accidents & Head Injury in Jaipur (Rajasthan)

Akhilesh Pathak, N.L. Desania** & Rajesh Verma***

Abstract

The injuries and death due to head trauma are inescapable in the modern way of life and their correct interpretation is vital to the reconstruction of the events of Forensic Medicine and their proper management for treatment of the injured. The present study was conducted in the department of forensic medicine, SMS medical college, Jaipur in year 2003-2004 to analyze the quantity of the magnitude of deaths due to Road Traffic Accidents (RTAs) and to provide epidemiological data, so the preventive measures can be undertaken. Our study shows that majority of the victims of RTA were male of middle age group (20-40 years), when they were going on two wheelers with out wearing helmets.

Key words : *RTA, Head Injury*

Introduction

India is undergoing major economic and demographic transition coupled with increasing urbanization and motorization. Among the top ten causes of mortality in the country, Road Traffic Accident was the tenth cause two decades back, but with the increasing urban expanse and lifestyle changes, it is projected that road traffic accidents will occupy the fifth position in the list of major killers and third position among causes of disease burden in 2020.

In India, 11% of deaths due to non-communicable diseases are due to injuries and 78% of injury deaths are due to road traffic accidents. It is the leading cause of mortality for young adults of less than 45 years and a major burden of disease across all age groups. Some of the factors that increase the risk of road crashes in India are unsafe traffic environment, poor road infrastructure and encroachments that restrict safe areas for pedestrians; lack of safety engineering measures; traffic mix and an increasing number of motorized vehicles; unsafe driving behavior and lack of valid or fake driving licenses.

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Absence of reliable and quality information could be one of the reasons for the lack of initiatives on better road safety measures. The existing data with the police, hospitals, insurance, and legal sectors is disintegrated and needs major revamping. The Integrated Disease Surveillance Project of the Ministry of Health and Family Welfare recognizing this problem proposes to include the injury module as an additional component. There is, however, a need to develop and test a model for surveillance of road traffic injuries for inclusion in the health information system.

Material & Methods

The present study was conducted in the department of forensic medicine, SMS medical college, Jaipur in year 2003-2004. Total 120 cases of head injury deaths were brought to mortuary directly from the spot or from accidental emergency or from neurosurgery department for the autopsy examination and out of these 79 cases of RTAs (65.83%) were selected for the present study. The epidemiological data were obtained with all pathological features of these cases as scalp injury, pattern of skull fractures and intracranial hemorrhages and their distribution were noted at the actual autopsy examination of victim with detailed history related to time, manner and hospitalization.

Results

Total 120 cases of fatal head injury were registered during the period of study and out of these 79 cases (65.84 %) were of RTAs, 28 cases (23.33%) were of fall from height and rest 13 (10.83%) were of assault and other traumas. Males were more prone to death by RTAs (79.75%) as compare to females (20.05%), making an M: F ratio 4:1. Incidence of RTA was more in third (24.06%) and fourth decade (18.99%) as compared to both extremes of life. The peak timings of RTAs were either morning hours of 9-12 or evening hours between 6-9. Incidence of deaths due to RTAs was maximum (49.37%) in two wheeler riders followed by pedestrians in 32.91% cases. Four wheelers were involved in 15.19% cases and bicyclists in only 5.53% cases. In two wheeler accidents most of the victims (87.17%) were not wearing any protective helmets at the time of incidence while in only 12.83% cases the victims died due to fatal head trauma even they were wearing protective helmets. The dominant type of skull fracture found was the linear (fissured) fracture in 43.04% cases followed by basilar fracture in 17.73%, comminuted fracture in 7.61%, crushes fracture in 5.06% and depressed fracture in 3.78% cases. In rest 22.78% cases, no skull fracture was found. The incidences of subdural hemorrhage (SDH) was maximum in 94.94% cases followed by subarachnoid hemorrhage (SAH) in 83.54% cases, intracerebral hemorrhage in 20.25% cases and extradural hemorrhage (EDH) in only 10.13% cases. We observed that all cases of EDH were found in association with SDH while 75% cases of SAH were found in association with SDH. In 63.29% cases the head injury was so severe that the victims could not survive even for 12 hours after the incidence and most of them died either on the spot, on the way or immediately after they get admitted in the casualty ward. Only 6.33% could survive up to 24-48 hours, 18.98% up to 3-7 days and 11.4% could survive more than 7 days following the intervention of particular treatment or appropriate surgery.

Discussion

Head injury is a major health problem all over the world. Motor vehicle accident is the leading cause of serious injuries with associated head trauma especially in youth and middle age. Despite of tremendous progress in all fields of life, RTA continues to be the major cause of morbidity and mortality in India.

External Cause	Number of cases	Percentage
RTAs	79	65.84
Fall from height	28	23.33
Assault	02	01.67
Others	11	09.16
Total	120	100

Table-1
Distribution of Head injury cases as per External cause

In present study also RTAs are the major cause of deaths due to head injury in 65.84% cases, similar to others [1,2,3,4]. The incidence of RTAs was higher in males and in 3rd to 4th decade of life, which is similar to most of the studies by various authors [1,2,3,5,6,7,8].

Age Group (In Years)	Male	Female	Total Case
0 – 9	03	05	08
10 – 19	08	01	09
20 – 29	18	01	19
30 – 39	12	03	15
40 – 49	10	02	12
50 – 59	04	03	07
60 & Above	08	01	09
Total	63	16	79

Table –2
Age and Sex wise distribution of RTAs

This can be also explained by the fact that during this age, people especially males are more mobile, go out for work and take risks, while elderly people, females and children usually stay at home.

In our study the common cause of RTA was two wheelers and pedestrian accidents in comparison to four wheelers and bicycles accidents, which shows that the four wheelers are comparatively safer than two wheelers.

Some other authors [3,5,8,12] found the pedestrians as the largest group of casualty in their studies. It might be because of different sample size. In two wheeler accidents we noticed that most of the victims who died because of fatal head injury were not user of helmets, which shows that the safety helmet can be the life saving during the accident involving two wheelers.

Time of Incidence	Cases- No(%)
0-3 AM	02(02.53)
3-6 AM	02(02.53)
6-9 AM	11(13.94)
9-12 PM	18(22.78)
12-3 PM	09(11.39)
3-6 PM	11(13.93)
6-9 PM	20(25.32)
9-12 AM	06(07.58)
Total	79(100)

Table-3
Distribution according to time of incidence

Motor Vehicle		Number of cases (%)	
Two Wheeler	Helmet Users	05	39(49.37)
	Helmet Non-users	34	
Four Wheeler		12(15.19)	
Pedestrian		26(32.91)	
Bicycle		02(5.53)	
Total		79(100)	

Table-4

The peak timings of occurrence of RTAs were 9-12 in the morning and 6-9 in the evening, which is probably due to heavy and unequal distribution of traffic at these working and closing hours of the people.

Type of Skull Fracture	Number of cases (%)
Linear Fracture	34(43.04)
Basilar Fracture	14(17.73)
Comminuted Fracture	06(07.61)
Depressed Fracture	03(03.78)
Crush Fracture	04(05.06)
No Fracture	18(22.78)
Total	79(100)

Table-5
Distribution according to type of Skull Fractures

The time of survival of head injury patients varies as per the severity of the trauma and also the kind of treatment and response of the patient to the same. We found that 63% of the victims of RTAs died either on the spot or with in 24 hours of the incidence, and the rest could survive for a couple of days to a maximum of two weeks after getting some medical or surgical interventions, similar to other studies [3,8.]

Type of Intracranial Haemorrhage	Number of cases (%)
Extra dural Haemorrhage	08(10.13)
Sub dural Haemorrhage	75(94.94)
Sub arachnoid Haemorrhage	66(83.54)
Intra cerebral Haemorrhage	16(20.25)

Table-6
Distribution according to type of Intra cranial hemorrhages

Most of the victims of fatal head injury were having linear fracture of either skull vault or base of the skull or both, especially in the thin areas of temporo-parietal bone. It might be due to because that this type of pattern is more common in cases where the head strikes by forcible contact with a broad resisting surface, as in RTAs.

Duration of Survival	Number of cases (%)
0-12 hours	29(36.70)
12-24 hours	21(26.59)
24-48 hours	05(06.33)
3-7 days	15(18.98)
> 7 days	09(11.40)
Total	79(100)

Table-7
Distribution according to Duration of Survival

The incidence of subdural hemorrhage (SDH) and subarachnoid hemorrhage (SAH) was maximum in the victims of RTAs while extradural hemorrhage (EDH) was observed in the least, which coincides with observations of others [1,3,9]. We could also summarize that almost all cases of EDH were found in age group of more than 20 years, which shows its lesser occurrence in children and adolescent. It might be due to the greater adherence of dura to skull, more elasticity of tissues and less atherosclerotic changes in arteries of brain, especially in younger age group[9].

Conclusion

Distribution and causes of intracranial injuries in present study are more or less similar to the pattern found in most of the other studies. This similarity is there in almost all parameters used in this study. These accidents occur more frequently in certain age groups, at certain times of day and at certain localities. Some people are more prone to accidents than others and the alcohol, un-awareness of traffic discipline and carelessness increase the susceptibility. The rate of incidence is higher in India because of its traffic patterns and possibly the lack of preventive measures such as helmets in motor cyclists and seatbelts in automobiles and poorly controlled traffic conditions and poor road conditions.

Finally more studies and research also needs to be done to provide a better understanding of the epidemiology of RTAs in Jaipur and how deaths by RTAs may further be reduced. In the mean time, we hope that the present study has contributed in some way towards the better understanding of this problem.

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Originals and Papers

Thermal Burn: An Epidemiological Prospective Study

Usama B.Ghaffar, Munnawar Husain** and Shameen J Rizvi****

Abstract

Fire was perhaps, man's first double-edged sword, for throughout history, it has served as well destroyed mankind.[1] Burns have tremendous medicolegal importance as they may be considered to be the commonest cause of unnatural death in India. Often, the circumstances of burns are enveloped in mystery, obscurity and unreliable statements. The reason behind this action may be personal, domestic, occupational or social tragedy, and more recently dowry death.[2]

The district of Aligarh is situated in the mid of Doab – the land between the Ganges and Yamuna Rivers, at a distance of 130 km southeast of Delhi-Howarh rail route and Grand Trunk Road. The latitude is 27° 54′ N and longitude is 78° 05′ E. The population of Aligarh is 3 million (657 people/km). Jawaharlal Nehru Medical College and Hospital attracts mainly rural patients from 1706 villages and 6 tehsils in and around Aligarh.

This prospective study was carried out on victims admitted to Burn Unit, Department of Plastic Surgery, Jawaharlal Nehru Medical College Hospital, Aligarh Muslim University, Aligarh. The objective was to analyze the epidemiological features, etiological factors and mortality of burn victims admitted to the unit.

Key words: *Epidemiology, mortality, accelerant, Aligarh, India*

Material and methods

This prospectively study was carried out in the Department of Forensic Medicine on 403 burn victims admitted to the Burn Unit, Department of Plastic Surgery, Jawaharlal Nehru Medical College, Hospital, Aligarh Muslim University, Aligarh, during the period from 1st July 2005 to 31st July 2007(n=403). The data was collected on the basis of age, gender, percentage of burn in terms of body Data collected was entered into a standard proforma prepared for this study and were analyzed. On the basis of analysis and observation, results were drawn and discussed and compared with other relevant literatures.

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*** Professor & Chairman, Department of Forensic Medicine, Principal, J.N. Medical College, Aligarh Muslim University, Aligarh- 202002.

Results

Age and gender

There were 189 males (46.9%) and females (53.1%) with female to male ratio of 1.13 to 1 (fig 1). Age distribution of victims show a peak between 13 to 25 years (41.5%), followed by 26 to 39 years (28.0%) and least number of victims (1.2%) above 60 years of age (fig 2). Mean age is 25.7 years.

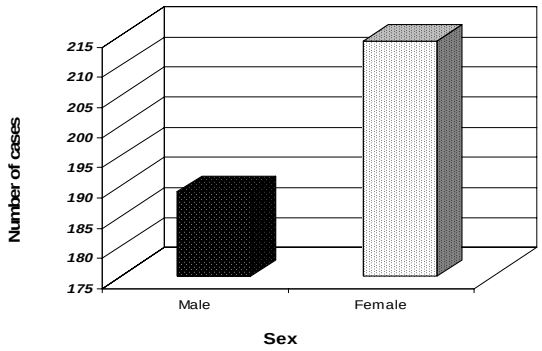

Figure-1 Sex incidence of case

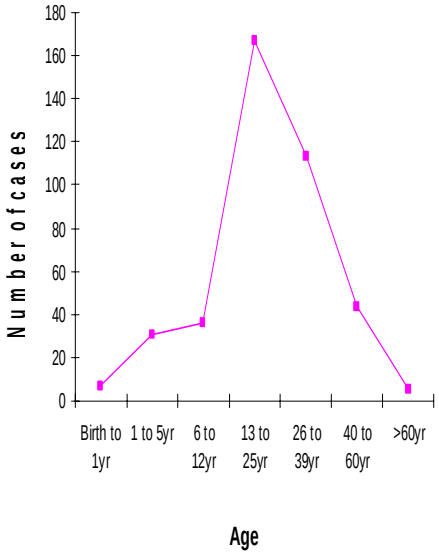

Fig 2: Age distribution

Place of residence

The place of residence of 403 victims were included in the study. Most of the victims (68.4%) came from rural (village) area and rest (31.6%) were from urban (city) area (fig 3).

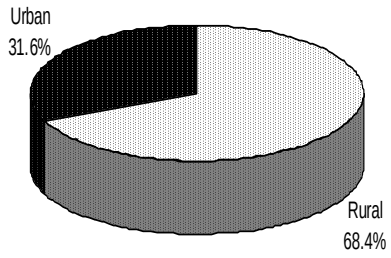

Fig. 3: Place of residence

Marital status

As per Table-1, most of the victims 72.5% were married and 27.5% unmarried with married-unmarried ratio of 2.6:1. Of the females 82.7% were married and 17.3% unmarried in contrast to males 60.8% married and 27.5% unmarried.

Marital status	Male No(%)	Female No(%)	Total No(%)
Married	115(60.8)	177(82.7)	292(72.5)
Unmarried	74(39.2)	37(17.3)	111(27.5)
Total	189(46.9)	214(53.1)	403(100)

Table 1: Distribution of burn in relation to marital status

Etiology of burn

Figure-4 illustrates the etiology of burn. Most of the burns were caused by Kerosene stove (32.3%), followed Flame (chulla etc) (23.1%), Electrical burn (16.4%), Kerosene lamp (14.2%), and hot liquid (6.2%)

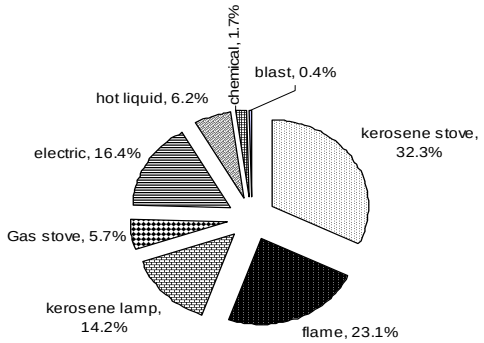

Fig. 4: Etiology of burn

Burn extent in relation to sex

Table-2 illustrates the relation between percentage of TBSA burnt and sex. It is evident that large of the victims (32.5%) had burns up to 25% TBSA followed by 26%-50% range (28.8%). Most of the male victims (49.2%) had burns upto 25% TBSA and in contrast most of the female victims (34.6%) had burns more than 75% TBSA .

Percentage of TBSA burnt	Male No(%)	Female No(%)	Total No(%)
Up to 25	93(49.2)	38(17.8)	131(32.5)
26 – 50	56(29.6)	60(28.0)	116(28.8)
51- 75	25(13.3)	42(19.6)	67(16.7)
76- 100	15(7.9)	74(34.6)	89(22.0)
Total	189(46.9)	214(53.1)	403(100)

Table 2: Burn extent in relation to sex

Distribution of mortality according to sex and Burn percentage

The distribution of mortality according to sex is given in Table 3 The overall mortality of 105 victims is 26.0% with males comprising 32.4% and females 67.4%. Distribution of mortality according to burn percentage is given in Table 6. It is evident that mortality in burns upto 25% TBSA was 17.7%, for 26%-50% TBSA it was 22.8%, for 51%-75% TBSA it was 27.7%, and it was 40.9% for victims with 76%-100% TBSA burns.(Fig.5)

Sex	Number of cases(%)
Males	34(32.4)
Females	71(67.6)
Total	105(100)

Table 3 Distribution of mortality according to sex

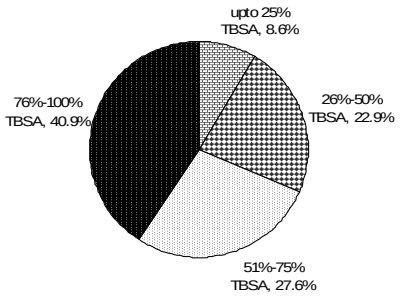

Fig5: Distribution of mortality according to burn percentage

Discussion

Burn injuries occur universally and has plagued mankind since antiquity till the present day. In all societies including developed or developing countries, burns constitute, a medical and psychological problem, but also has severe economic and social consequences not only to them, but also to their family and society in general.[3]

Analysis of sex and age record in our study showed that males (46.9%) superceded females (53.1%). The overall female predominance in our study conforms with some previous reports[4,5,6] and contrasts other epidemiological studies [7,8] which show male predominance. Young adults in 13 to 25 years age group, constituted maximum number of cases 41.5% of the total and least number of cases 1.2% were in the age group above 60 years. These results are consistent with the work of other reporters.[5,9,10,11,12] Women in this age group are mostly engaged in cooking and wear loose fitting clothes like Saree, dupatta, etc, which catch fire easily.[13] Loose fitting clothes are not only worn by women but also by men in the form of dhoti, lungi and phiran which also puts them at a risk from this cause.[14]

In our study maximum number of victims were from rural area (68.4%) than from urban area (31.6%). Thus it is obvious that majority of victims come from rural background although J.N. Medical College is located Aligarh town, it attracts patients from the entire Aligarh district and neighbouring districts. Burn victims due to serious nature of illness and because of medicolegal reasons are referred to this apex hospital.

Regarding the marital status, our study showed that married male (60.8%) and married female (82.7%) outnumbered unmarried males and females. The preponderance of female victim is probably because of increasing familial stress due to day to day problem like jobs, cooking, children, etc and hurrying through in an overcrowded room with minimal amenities inviting frequent accidents. Moreover in the developing country like India, females are married earlier than males in the family and are more exposed to social and family stress much earlier than males. This is in accordance with the work of Ambade V.N and Godbole H.V.[12]

Thermal burns being most common type is also reported by most of the workers, Among the causes of thermal burns leading causes are Kerosene stove (32.3%), open flame (chulla etc.) (23.1%), Kerosene lamp (14.2%)

and Gas stove (5.7%). Thus Kerosene was the main accelerant accounted for burns. This is probably because kerosene is cheap and easily accessible and more use of kerosene stove and kerosene lamp by the people of low socioeconomic strata in India, where obsolete and unsafe uses of fire for cooking and light are still prevalent. Similar facts have has been previously emphasized by other authors.[4,6,10,12,15] In contrast Dasgupta and Tripathy[18] in their study found that the largest number burn deaths were due to the use of match stick (35.6%), followed by wood burner (28.7%), and kerosene burner (18.4%).

In our study maximum number of male victims (49.2%) had burns upto 25% of TBSA. This is in accordance with the findings of other authors.[9,15,17] But the maximum number of female victims (34.6%) in our study had burns of more than 75% of total body surface area which is also reported by V. Jayaraman et al.[10] In India, cooking remains the primary responsibility of females and that requires the association with fire sources could be responsible for higher proportion of deaths. Thus females are at a definite and dangerous exposure with an open unguarded fire in the low. Moreover an existing male preferential and dominant socio-cultural situation socio-economic and agricultural Indian society.[12]

The overall mortality in this study was 26.0% and was higher in females (67.6%) than in males (32.4%). Similar mortality rates has been mentioned by, Ghuliani K. K. et al.[18] reported 28% mortality, Abddolaziz Rastegar Lari et al.[19] reported 19.6% mortality rate. Maximum number of female victims (34.6%) had burns more than 75% TBSA and also the overall maximum number of deaths (40.9%) occurred in patients with > 75% TBSA. Among the victims who died maximum were females. This is in accordance with finding of Gupta M et al.[20] In contrast Sinha R.C and Verma S.K[21] reported highest mortality in males. The difference in the mortality rates quoted by western and Indian workers in general may reflect the facilities provided at burn care units. Discrimination against female species starts even before she is born and it is the male child gets all the attention after birth. Even in adulthood the female is considered to be a burden on her family. After marriage the treatment meted out by the in laws to the poor female is well known. Families usually don't want to spend money on the treatment of female patient and this may be one of the reasons for high mortality in females.

Conclusion

The epidemiological factors of burn injury vary in different countries. For planning and implementing prevention programs the approach have to be multi-disciplinary and coordinated and may be largely accomplished by providing immense amount of education so as to build awareness in the mind set of general population, school education programs, male concerning risk in work locations, the family especially the housewives and parents. Educating the masses through the media showing various risk factors together with epidemiological data about burn injuries and call attention to make strategies to prevent these accidents. So, as long as the problem of deaths by burn persists in India, the government needs to concentrate in this direction and the NGOs, social groups, and workers need to put in more sincere efforts. Steps should be taken not only to minimize burn mortality but also to prevent and reduce their incidence at least in cases where human error and human greed plays a role.

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Originals and Papers

Determination Of Malathion In Blood And Urine Using Thin-Layer Chromatography

A.K.Jaiswal[*] , Ashmeet Kaur[**], T.Millo[***], Adarsh Kumar[***] & M.Gupta[****]

Abstract

Malathion is a broad-spectrum Organophosphorus insecticide generally used to control a variety of insects. Routinely it is analysed by Gas Liquid Chromatography & High Performance Liquid Chromatography. Now an attempt has been made to develop a new method for analysis of Malathion in biological samples using Thin Layer Chromatography (TLC) technique, which is inexpensive, accurate and non-destructive. Malathion was extracted from blood and urine using solvent extraction methods and then identified on the TLC plates.

For chromatographic separation, various binary and tertiary solvent systems were used to demonstrate in the laboratory. For detection on developed plates, palladium chloride reagent was used which successfully increased the sensitivity without dispensing with the simplicity of the method. For the analysis, a total of 20 solvent systems were chosen. Out of these 20 solvent systems, the three best solvent systems namely Cyclohexane: Chloroform (60:40), Hexane: Acetone (80:20) and Acetone: Hexane: Toluene (40:40:20) were chosen for statistical analysis which included the calculation of mean Rf value, value of standard deviation and coefficient of variance. The method developed is simple, inexpensive, accurate and non-destructive that allows for sensitive and reproducible analysis of Malathion.

Keywords: *Organophosphorus compound, Malathion, palladium chloride, hRf, TLC plate*

Introduction

Malathion is a pesticide that is used to kill insects on agricultural crops, on stored products, in home gardens, and in outdoor sites. It is also used to kill mosquitoes in large outdoor areas. Additionally, Malathion is used to kill fleas on pets and to treat head lice on human beings. Malathion is available in the market in two forms: a pure form of a colourless liquid and a technical-grade solution (brownish-yellow liquid), which contains malathion (greater than 90%) and impurities in a solvent. Comercially it is available as kill bug,bugsolin etc[1-5].
It belongs to alkyl group of phosphate comprising of diethyl (dimethoxythiophosphorythio) succinate.

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Its molecular formula is $C_{10}H_{19}0_6PS_2$ and molecular weight is 330.3. Technical grade is 95%pure, melting point -2.85^{0}C, boiling point-156-157^{0}C, vapour density-5.3 mPa (30^{0}C), density- 1.23 (25^{0}C).

It is readily soluble in most organic solvents, e.g. alcohols, esters, ketones, ethers, aromatic hydrocarbons; slightly soluble in petroleum ether and some types of mineral oil. It does not mix well with water so it is usually mixed with oily liquids before it is applied to crops or animals. Formulation for malathion include emulsifiable concentrate, dust, flowable, granular wettable power [6-12].

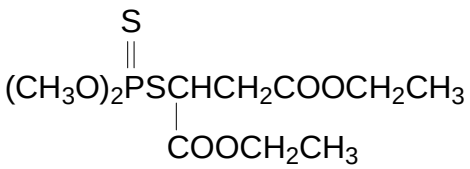

Figure-1:Structure of Malathion

The present study involves separation of Malathion from blood and urine using different extraction methods and then identifying them on the TLC plates. For chromatographic separation various binary and tertiary solvent systems were used to demonstrate in the laboratory. The most effective solvent systems are described here. For detection on developed plates, palladium chloride reagent was used which successfully increased the sensitivity without dispensing with the simplicity of the method [13-20].

Material and Methods

(A) Reagents and Equipment:

a) Solvent mixture: All reagents of analytical grades were used.
b) Visualising Reagent: Palladium chloride (Merck limited, Worli, Mumbai)
c) Equipment: TLC Aluminium sheet Silica gel 60 F_{254}, Merck KGaA, Germany.
d) Chromatographic chamber: Glass chromatographic chamber were used so that a TLC plate is placed in a slightly inclined position.
e) Sample application: Fine glass capillary was used for spotting the sample on TLC plate.

(B) Sample preparation

i. Standard Solution: 1000-ppm solution of Malathion in acetone was prepared by dissolving 0.1 gm of known Malathion standard in 100 ml acetone.
ii. Visualising Reagent: 0.5 gm of palladium chloride was dissolved it in 100 ml of water & then acidified upto the solution was pH 3, by using drops of concentrated Hydrochloric acid.
iii. Preparation of development tank: A glass chamber of suitable size with an airtight lid was perfectly saturated with vapours of solvent system for 20-30 min. For each solvent system separate cleaned chambers were used. The spotted plate was inserted and sealed to maintain airtight environment.

a) Extraction from blood [9]:

10ml of blood was spiked with 3 ml of malathion and kept in incubator overnight. It was mixed with 10ml of 10% sodium tungstate solution and 15ml of 1 N. Sulphuric acid, shaken for two minutes and then filtered. The residue was washed with 2 X 15ml of 0.1 N sulphuric acid. The washings were collected and mixed with the filtrate, transferred into a separating funnel and extracted thrice with 20ml portions of n-Hexane. The hexane layers were combined, passed through anhydrous sodium sulphate and the solvent was removed by evaporation.

b) Extraction from urine [9]:

10 ml of urine was spiked with 3 ml of Malathion and kept in incubator overnight. This is taken in a conical flask .To it 25 ml of n-Hexane was added and contents were refluxed on a warm water bath for half an hour. After cooling, the liquid was filtered& mixed with 10ml n-Hexane and taken in a separating funnel. The n-Hexane layer was separated, passed through anhydrous sodium sulphate and evaporated to dryness.

c) Procedure

The sample which was extracted from blood and urine along with the standard sample was spotted on the TLC plate. The spots were allowed to dry and spotted plate was developed with different solvent systems. The approximate development time for a ten-centimetre TLC plate was fifteen to twenty minutes. The plate was allowed to dry and then spots were viewed using the palladium chloride, visualising reagent.

The solvent systems used in the study included the following:

1. Cyclohexane:Chloroform (40: 60)
2. Cyclohexane:Chloroform (50: 50)
3. Cyclohexane:Chloroform (60: 40)
4. Cyclohexane: Toluene (50: 50)
5. Benzene (100)
6. Benzene: Methanol (40: 60)
7. Benzene: Methanol (50: 50)

8. Acetone: Benzene (50: 50)
9. Acetone: Benzene (60: 40)
10. Acetone: Benzene (70: 30)
11. Acetone: Benzene (80: 20)
12. Hexane: Acetone (80: 20)
13. Hexane: Acetone (70: 30)
14. Hexane: Acetone (60: 40)
15. Hexane: Acetone (50: 50)
16. Hexane: Chloroform (50: 50)
17. Hexane: Chloroform (60: 40)
18. 18.Hexane: Chloroform (70: 30)
19. Acetone: Hexane: Toluene (40: 40: 20)
20. Hexane: Acetone: Cyclohexane (50: 20: 30)

TABLE 1: hRf VALUE OF MALATHION IN DIFFERENT SOLVENT SYSTEMS

SOLVENT SYSTEM	STANDARD	BLOOD EXTRACT	URINE EXTRACT
Cyclohexane: Chloroform (40: 60)	37	37	36
Cyclohexane: Chloroform (50: 50)	22	22	22
Cyclohexane: Chloroform (60: 40)	20	21	21
Cyclohexane: Toluene (50: 50)	12	11	12
Benzene (100)	17	17	17
Benzene: Methanol (40: 60)	30	30	31
Benzene: Methanol (50: 50)	05	05	05
Acetone: Benzene (50: 50)	93	93	92
Acetone: Benzene (60: 40)	95	94	94
Acetone: Benzene (70: 30)	96	96	96
Acetone: Benzene (80: 20)	97	97	97
Hexane: Acetone (80: 20)	46	46	46
Hexane: Acetone (70: 30)	50	50	51
Hexane: Acetone (60: 40)	92	92	92
Hexane: Acetone (50: 50)	96	96	96
Hexane: Chloroform (50: 50)	24	25	24
Hexane: Chloroform (60: 40)	37	37	36
Hexane: Chloroform (70: 30)	52	50	51
Acetone: Hexane: Toluene (40: 40: 20)	77	76	77
Hexane: Acetone: Cyclohexane (50: 20: 30)	50	50	50

Results and Discussion

After the TLC plates were sprayed with the palladium chloride, Malathion appeared as yellowish-orange spot surrounded by brown on a white background. The reaction was instantaneous. Separation using different solvent systems gave different Rf values (as shown in Table 1) for Malathion. Colour formation was permanent. The method described above was sensitive to Rf value of Malathion extracted from blood and urine under experimental conditions and was found nearly equal to that of standard used. The results are presented in Table 1. Values of hRf (distance travelled by the sample divided by the distance travelled by the solvent times 100) are presented in the table as well.

All in all the analysis was done on a total of 20 solvent systems, out of which the three best solvent systems namely Cyclohexane: Chloroform (60: 40), Hexane: Acetone (80:20) and Acetone: Hexane: Toluene (40:40:20) were chosen and statistical analysis was performed on these systems. The performed statistical analysis included calculation of mean Rf value, value of standard deviation and coefficient of variance whose results are presented in tables 2, 3 and 4. In case these three best solvent systems are not available, other mentioned solvent systems can also be used for the analysis of Malathion.

TABLE 2

REPLICATE Rf VALUES OF MALATHION IN SOLVENT SYSTEM CYCLOHEXANE: CHLOROFORM (60:40)

Trial	Rf (Standard)	Rf (Blood Extract)	Rf (Urine Extract)
1	0.20	0.21	0.21
2	0.19	0.20	0.19
3	0.21	0.21	0.20
4	0.20	0.20	0.21
5	0.20	0.21	0.20
6	0.21	0.20	0.20
7	0.19	0.19	0.20
8	0.21	0.20	0.21
9	0.20	0.20	0.20
10	0.21	0.21	0.20
	Mean Rf Value: 0.20 Standard Deviation: 0.0078 Coefficient of Variance: 3.90%	**Mean Rf Value: 0.20 Standard Deviation: 0.0067 Coefficient of Variance: 3.35%**	**Mean Rf Value: 0.20 Standard Deviation: 0.0063 Coefficient of Variance: 3.15%**

Conclusion

Due to the time involved in screening malathion with other analytical methods, such as GC (gas chromatography), alternative methods were sought. TLC proved to be an excellent choice because it is both fast and economical. Malathion is easily visualised with spray reagents such as Palladium chloride. Since many factors affect hRf values, standard sample should always be used in conjunction when screening malathion with TLC to avoid misidentification.

Acknowledgement

The authors are thankful to Dr T.D. Dogra, Professor & Head of Department of Forensic Medicine and Toxicology, AIIMS, New Delhi for his encouragement towards research work and providing necessary facility.

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TABLE 3: REPLICATE Rf VALUES OF MALATHION IN SOLVENT SYSTEM

HEXANE: ACETONE (80:20)

Trial	Rf (Standard)	Rf (Blood Extract)	Rf (Urine Extract)
1	0.46	0.46	0.46
2	0.47	0.46	0.45
3	0.46	0.46	0.45
4	0.45	0.47	0.47
5	0.46	0.47	0.46
6	0.46	0.45	0.46
7	0.45	0.46	0.46
8	0.47	0.46	0.46
9	0.46	0.47	0.47
10	0.47	0.45	0.47
	Mean Rf Value: 0.46 **Standard Deviation: 0.0074** **Coefficient of Variance: 1.61%**	**Mean Rf Value: 0.46** **Standard Deviation: 0.0073** **Coefficient of Variance: 1.59%**	**Mean Rf Value: 0.46** **Standard Deviation: 0.0074** **Coefficient of Variance: 1.61%**

TABLE 4 : REPLICATE Rf VALUES OF MALATHION IN SOLVENT SYSTEM

ACETONE: HEXANE: TOLUENE (40:40:20)

Trial	Rf (Standard)	Rf (Blood Extract)	Rf (Urine Extract)
1	0.77	0.77	0.76
2	0.79	0.77	0.78
3	0.79	0.76	0.76
4	0.77	0.76	0.77
5	0.76	0.78	0.77
6	0.78	0.79	0.76
7	0.76	0.76	0.78
8	0.76	0.75	0.77
9	0.76	0.76	0.76
10	0.77	0.76	0.78
	Mean Rf Value: 0.77 **Standard Deviation: 0.0120** **Coefficient of Variance: 1.56%**	**Mean Rf Value: 0.76** **Standard Deviation: 0.0117** **Coefficient of Variance: 1.54%**	**Mean Rf Value: 0.77** **Standard Deviation: 0.0087** **Coefficient of Variance: 1.13%**

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Case Report

Detection Of Ranitidine By Thin Layer Chromatography Technique-A Case Study

V. Dhingra, U.Mishra** & Jyotsna Pandey***

Abstract

In one case, viscera of a lady was received, who expired following injection given by doctor in urban area. After conducting elaborate analysis data were found similar to Ranitidine. Hence, it was thought worthwhile to concentrate on this drug .The present paper describes the extraction of Ranitidine from visceral material and its identification by thin layer chromatography using suitable solvent system and potassium iodo bismuthate as locating reagent.

Keywords : *Ranitidine, Zantac, T.L.C.*

Introduction

Ranitidine is used to treat and prevent ulcers in the stomach and intestines and sold under trade name *Zantac*. Ranitidine is also used to treat conditions in which the stomach produces too much acid[1] and conditions in which acid comes up in to the esophagus and causes heartburn, such as gastro esophageal reflux disease (GERD).[2]

Symptoms of a ranitidine overdose include nausea, vomiting, diarrhea, increased saliva production, difficulty in breathing, and a fast heartbeat. H-2 receptor antagonists rarely cause blood dyscariasis or abnormality in liver or cardiac function. How ever, rapid injection of these drugs may cause reversible bradycardia and hypotension through blokade of cardiac H-2 receptors.[3]

Some individual may have an allergic action of this compound. The other possible side effects of ranitidine are allergic reaction like closing of throat; swelling of lips, tongue, or face or unusual bruising or bleeding gums, yellowing of the skin or eyes. Other, less serious side effects may occur like dizziness, headache, diarrhea, nausea and constipation even when drug levels are below minimum levels to produce an allergic reaction.

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It is not known whether toxicity may result from continuous low level intake or synergistic action of drug combinations. The widespread utilization of Ranitidine drug by the medical practitioners without due consideration of these factors have adversely affected in many cases.

Chemically it is N [2-[[[5(dimethylamino) methyl]-2-furanyl] methyl] thio] ethyl]-N -methyl-2-nitro-1, 1-ethenediamine, HCl. It has the following structure:

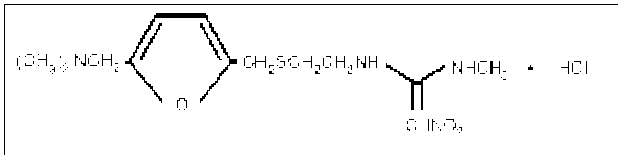

Figure-1:Structure of Ranitidine

Ranitidine is marketed only as the hydrochloride salt. The molecular formula of Ranitidine is $C_{13}H_{22}N_4O_3S \cdot HCl$, representing a molecular weight of 350.87. Ranitidine HCl is a white to pale yellow, granular substance that is soluble in water. It has a slightly bitter taste and sulfur like odor.

After conducting a brief survey of literature a reproductive method for the identification of this compound in visceral tissue was not reported. The
focus of our study has been in methods for detection and confirmation of Ranitidine in biological tissues using thin layer chromatography.

Experimental

All the reagents used were analytical reagent grade; distilled water was used throughout the study.

Preparation of reagent[4,5]

Potassium Bismuth Iodide

(a) 2g of bismuth sub nitrate, 25 ml of acetic acid and 100 ml of water were mixed together, **(b)** 40 g of potassium iodide was dissolved in 100 ml water, **(a)** 10 ml & **(b)** 10 ml were mixed and 20 ml acetic acid was added to it solution was used for spray.

Extraction of Ranitidine from autopsy material:

In a portion of about 100 g each of various biological tissues (stomach, intestine, liver spleen and kidney) containing the g above mentioned drug, 10g ammonium sulphate was added and minced in an aqueous solution. Then biological sample was made alkaline with the help of ammonia and sample was extracted in a separating funnel with 150 ml of mixture of ethyl alcohol: water (10:90) was added this was again extracted with 100 ml mixture of ethyl alcohol: water (10:90) The filtrate were combined and evaporated up to 10 ml. The extracts were combined and subjected to clean up by passing through the mixture of silica gel g and activated charcoal filled column having glass wool at the bottom. Finally in the collected filtrate was evaporated up to 1 ml over hot water bath and can directly used for identification Ranitidine.

Thin layer chromatographic analysis

A standard glass TLC plates was coated with slurry of silica gel G in water to a uniform thickness of 0.25 mm. The plate was activated by heating in an oven at 110^{O}C for about one hour. Aliquots of standard Ranitidine and extract obtained from autopsy material were spotted on to the plate, which was developed with Methanol: Ammonia (100:1.5) in a pre saturated TLC chamber, to a height of 10 cm. The plate was removed from the chamber dried in air and sprayed by Potassium iodo Bismuthate reagent that gave orange colored spot at 0.53. The R_f value of Ranitidine can be compared with the obtained spots of visceral extract.

Results And Discussions

The prescribed developed method and the analysis of Ranitidine in visceral tissue could prove that the injection Ranitidine was given to the lady. This method is sensitive and can detect ranitidine up to 10μg concentration by thin layer chromatography and can be used for routine analysis. The question before investigating officer in any death alleged to have occurred due to drug reaction, is "Whether deceased was given Ranitidine (or other drug) injection ?".

By such meticulous analysis it can be opined in a positive manner and hence sufficient to establish that the alleged drug had been given. However, the subsequent questions of drug over dose, adverse reaction and its contribution to death need considerations like circumstantial evidence, post mortem findings etc.

Acknowledgement

Authors are thankful to Director, State Forensic Science Laboratory, and Sagar MP for providing laboratory and library facility.

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Case Report

Lizard Bite In Indian Child : Case Report

Amar M. Taksande,Pankaj Murkey**, Arvind Kumar*** & K.Y.Vilhekar*****

Abstract

Lizard bite is very uncommon in children. Here we report a child who had bitten by lizard on the right thumb and recovered without any complication.

Key words: *Lizard bite, child*

Introduction

Lizard bite is very uncommon in children. Only two species of lizard are poisonous i.e. Gila Monster (heloderma suspectum with 2 sub species) and Mexican beaded Lizards (heloderma hornidum with 3 species). Bites are very infrequent and usually involve captive specimens. Here we report a child who had bitten by lizard on the right thumb and recovered without any complication.

Case Report

A one year female child presented with history of lizard bite on the right thumb. Child cries excessively several minutes after the bite. There is no history of vomiting, diaphoresis, cyanosis, fever, convulsion, or altered sensorium. On general examination, bleeding from the right thumb (bite area) with mild swelling was present (Figure 1). Two small puncture wounds were present on the bite area. Child was afebrile, pale, pulse rate of124/m; respiratory rate of 34/m; and blood pressure was 90/60mmHg. Systemic examination was within normal limit. On investigation, complete blood cell count was: Hb: 11gm%, TC: 5,600/cmm (LY32%, MO 10%, GR 58%) and platelet count: 4.7 lac/cmm.

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The wound was cleaned, and betadine ointment dressing was applied. Analgesic and Oral antibiotic (Syrup Amoxycillin) was started. No undue event was occurred and child was discharged after 48 hrs of hospital stay. On follow up, after 3 day, there was no evidence of infection and bite area healed.

Discussion

Lizard bites may be frightening, but most of the species do not cause serious health problems. Out of 3000 species of Lizard's worldwide, only two species i.e. Gila monster and Mexican Beaded lizard are venomous. In India, none of these varieties are found. Old people believe that even the breath or the urine of the Lizard is poisonous. A bite from a lizard leave teeth marks, a minor scrape, or a puncture wound without other symptoms. A significant number of bites probably go unreported because private keepers of these protected lizards may be reluctant to seek medical attention. Home treatment often relieves symptoms and helps prevent infection. In India, only reassurance to the relative or the person bitten by lizard is sufficient (1). Envenomation by poisonous variety occurs by contamination of the wound with venom which is neurotoxic in nature. Changes in level of consciousness, such as unconsciousness, confusion, or extreme sleepiness, severe immediate pain with rapid swelling at the site of the bite, numbness or tingling at or near the bite site. Envenomation result in tissue injury, excruciating pain,massive

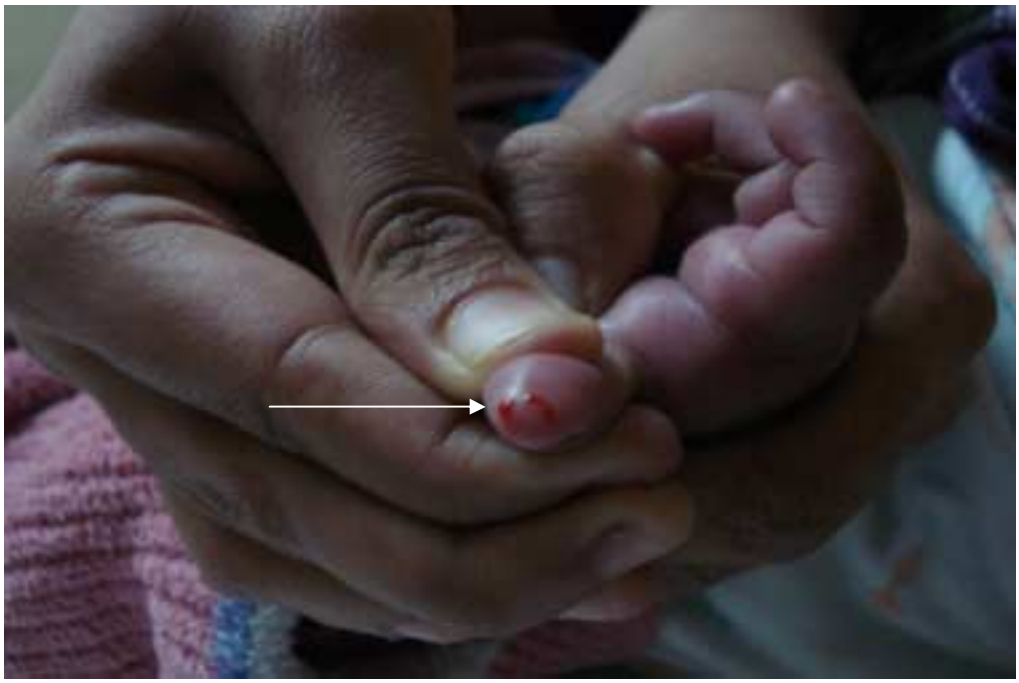

Figure-1: The photograph showing right thumb and bleeding present on the bite site. Also note swelling of all digits.

edema and patchy erythema. Systemic symptoms are nausea, vomiting and hematemesis, blurring of vision, dyspnoea, dysphonia and profound weakness. Severe pain following a helodermatid bite may lasts many hours and generalized weakness may persists for several days. Cantrell FL (2) also reported anaphylaxis secondary to Gila monster lizard envenomation. Systemic manifestation usually last for 3-4 days. Hyperesthesia in the bitten extremities may persist for several weeks. Systemic toxicity usually resolves within one to two days with supportive care. To help estimate the severity of envenomation, it is important to estimate the length of the time the Lizard remained attached to the victim. While an effective envenomation can occur with a contact time of few seconds, if the Lizard manages to hang on for a period of minutes, the bite could be very serious, probably lethal. Failure to fully evaluate a victim with a significant helodermatid bite potentially could lead to missing a rare coagulopathy or myocardial infarction. Much more likely is the possibility of retained foreign body (eg. Tooth) in the bite wound if the site is not examined carefully.

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Review Article

Occupational hazard with "PRIONS"- in Autopsy workers

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Abstract

Autopsy room as a potential source of infection to Forensic Pathologists / Autopsy Surgeons and other personnel assisting to conduct an autopsy is a well documented fact. Most frequently reported infections are tuberculosis, brucellosis, salmonellosis, HIV, hepatitis viruses (HBV, HCV etc). New worrisome infective agents called 'PRIONS' are associated with degenerative diseases of the central nervous system (CNS) in man and animals (e.g. Mad Cow Disease). Prions are proteinaecious infective agents characterized by extreme resistance to conventional inactivation procedures and transmissible through food, contaminated instruments etc.

Key words: *Prions, Lab Personnel, Transmissible spongioform encephalopathies*

Introduction

The necessity to review the information on laboratory associated infections is that they are a potential threat to health care workers and general population alike. Employing untrained or inadequately trained personnel, emergence of drug resistant and unusual infective agents and non-compliance of biosafety procedures in developing countries are difficult hurdles. Staff move freely between all departments of the hospital which include Laboratory and Mortuary.

The postmortem room and mortuary work are with serious occupational risk of infections[1].

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Novel class of infective agents – 'PRIONS' (Unconventional infective agents):

Well known microorganisms which we have been dealing with contain both nucleic acid and protein. Bacteria. Fungi and parasites contain both DNA and RNA. Whereas viruses contain either DNA or RNA but never both.

The term prion, (pronounced **pree-on** and derived from 'proteinaecious infectious particle') refers to a small infectious agent that consists of protein but lacks nucleic acid[2]. Prion diseases are seen in the form of degeneration of the CNS in man and animals called Transmissible Spongiform Encephalopathies (TSEs), because of the presence of large vacuoles in the cerebral cortex and cerebellum.

Prion Diseases

These are slow, progressive, neurodegenerative diseases. Table 1 shows the list of Prion diseases in man & animals. Scrapie is the prototype disease.

Prion diseases are rare & occur world wide[3].

TABLE 1 : Prions diseases (sporadic, inherited and transmissible forms)

Human:
Kuru
Creutzfeldt-Jakob disease (CJD)
Variant CJD (v CJD)
Gerstmann-straussler-scheinker (GSS syndrome)
Fatal familial insomnia (FFI)
Animal:
Scrapie (sheep and goats)
Transmissible mink encephalopathy
Bovine spongiform encephalopathy (BSE, mad cow disease)
Chronic wasting disease (mule, deer and elk)

Infection and Pathogenesis

In spongioform encephalopathies vacuolations of neurons, loss of their function, formation of plaques and fibrils containing prion protein (PrP^{sc}) and lack of an immune response or inflammation are characteristic features . The incubation period may be long, 1-30 years and the patient dies within a year after the symptoms become evident. Infection occurs through cuts in the skin, transplantation of contaminated tissues, (e.g. Cornea), use of contaminated medical devices (brain electrodes) and by ingestion of infected tissue[2,3]. Iatrogenic CJD has been transmitted accidentally by contaminated growth hormone preparations from human cadaver pituitary glands, by corneal transplant, by contaminated surgical instruments, and by cadaveric human dura mater grafts used for surgical repair of head injury[8].

BSE and vCJD

(Bovine Spongiform Encephalopathies and variant Creutzfeld-Jacob Disease)

Considerable evidence supports the hypothesis that vCJD represents Bovine to human transmission of BSE popularly known as Mad cow disease. Cattle, fed on ruminant-derived proteins in feeds (e.g. scrapie infected sheep tissue derived protein) develop Mad cow disease[2,3]. Humans have consumed an estimated 50,000 BSE infected cattle (in the year 1996 - 1,80,000 cattle were slaughtered to prevent spread in UK)[4].

Clinical Features

TSEs are characterized by a loss of muscle control , shivering, myoclonal jerks and tremors, loss of coordination, rapidly progressive dementia and death. **vCJD** has been effecting young adults less then 40 years of age , manifesting predominantly as psychiatric disorders[2].

Lab diagnosis

The most reliable means for diagnosing any TSE is the microscopic examination of brain tissue – a post-mortem procedure. Preliminary diagnosis of vCJD are based on patient history, clinical symptoms, Electroencephalograms, and Magnetic Resonance Imaging of the brain[5]. Conformation of diagnosis can be made by detection of prion protein in a western blot using an antibody in a tonsil biopsy[3]. At autopsy, the characteristic amyloid plaques , spongiform vacuoles and immuno-histologically detected prion protein can be observed. The only specific diagnostic test is CDI (Conformation dependant immunoassay) in which PrP 27-30 is detected by immunoassay[6].

Inactivation of Prions

Prions are characterized by extreme resistance to conventional inactivation procedures including irradiation, boiling, dry heat and chemicals (formalin, Beta-propiolactone and alcohols). They are inactivated by 1N Sodium Hydroxide (NaOH); 4.0 Guanidine hydrochloride or isocyanate; sodium hypochloride (2% free chlorine concentration); steam autoclaving at 132˚ C for 4.5 hrs and incineration[5]. Formalin fixation does not destroy prion infectivity. A relatively simple method to eliminate virtually all residual infectivity of prions in formalin fixed tissue blocks is by immersion of the block for 1 hour in formic acid followed by further

fixation in formalin[8]. Because prions can be transmitted on instruments and brain electrodes, such items should be carefully disinfected before being reused. Stainless steel instruments also may retain infectivity even after treatment with 10% formaldehyde. These instruments should be immersed in 1N NaOH, thrice for 30 minutes each time. It appears that inadequate autoclaving can establish heat resistant sub-populations[2].

Precautionary measures

Some standard precautions for autopsy of patients with suspected Prion diseases[5]:-

1. Standard autopsy attire is mandatory.
2. The brain is removed while the head is in a plastic bag to reduce aerosolization and splatter.
3. Instruments and saw blades are placed into a large stainless steel dish and soaked for one hour in 2N NaOH or two hours in 1N NaOH and then rinsed well in water before autoclaving at 134 ° C (gravity displacement steam autoclaving for one hour; porous load steam autoclaving for one 18 minute cycle at 30 lbs psi or six 3 – minute cycles at 30 lbs psi).
4. The absorbent table cover, instrument pads, disposable clothing etc are double bagged in appropriate infectious waste bags for incineration.
5. Any suspected areas of contamination of the autopsy table or room are decontaminated by repeated wetting over one hour with 2N NaOH.
6. In preparing sections, gloves are worn, section waste is collected and disposed off in a biohazard waste receptacle. The knife stage is wiped with 1-2 N NaOH, and the knife used is discarded immediately in a "biohazard sharps" receptacle. Slides are labeled with "CJD precautions". The sectioned block is sealed with paraffin.

Levels of infectivity with Prions[1]

Prions are placed in Hazard Group 3 in Biological agents directive (EC 1993).

Three degrees of infectivity in tissues and body fluids are indicated by ACDP (Advisory committee on dangerous pathogens 1994-97):

1. Highest titers of prions are found in brain, spleen, spinal cord, thymus, tonsil, eye, peripheral lymph nodes, placenta, and gut associated lymphoid tissue.
2. Moderate or low titers in major peripheral nerves, cerebrospinal fluid, adrenal gland, liver, lung and pancreas.
3. Materials unlikely to be infected are semen, saliva, skin, urine, muscle, faeces, kidney and blood.

Conclusion

The absence of any known perfect inactivation or treatment of prions, demands caution at all places of work, all the more at the Mortuary !

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Review Article

Neurological manifestations in Organophosphorous toxicity

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Abstract

Organophosphorous compounds are one of the efficient methods available for pest control. Because of its easy availability, the various preparations of organophosphorpus compounds cause significant morbidity and mortality to the human lives. In addition to producing pesticide related illness and death, Organophosphorous compounds produces different neurological manifestations as a sequelae to its toxicity. Four such neurological syndromes are discussed with their salient clinical features.

Key Words: *Organophosphorous compounds, neurological syndrome, toxicity*

Introduction

Organophosphorous compounds stakes a major claim in morbidity and mortality due to poisoning. The toxicological features begin with a short period after consumption and progressively increase with time. In addition to the conventional presentation of the clinical features, these compounds produce different neurological manifestations.

Discussion

There are four types of neurological syndromes associated with organophosphorous poisoning.

1) Cholinergic phase
2) Intermediate syndrome
3) Organophosphate induced delayed polyneuropathy (OPIDN)
4) Chronic organophosphate induced neuropsychiatric disorder (COPIND)

1. Cholinergic phase:

This is the initial phase of acute organophosphate poisoning which occurs due to the excess of acetyl choline. It was called as type I paralysis.[1]

They generally recover with adequate treatment. The symptoms are either muscarinic or the nicotine type. The most severe manifestation in this type is respiratory failure.

2. Intermediate syndrome:

The term intermediate syndrome was first coined by Senanayake from Srilanka in 1987.[2] but intermediate syndrome was first described by Wadia as type II paralysis in 1974.[1]

It was called as Intermediate because it appears after the acute cholinergic phase but before the expected onset of delayed neuropathy. The cardinal features of this syndrome are cranial nerve palsies, weakness of neck flexors, proximal muscle weakness and respiratory muscle paralysis which usually develops between 24 to 96 hours of ingestion of the poison.[3]

The mechanism of intermediate syndrome is not clear. It was felt by some authors that it may be due to the nicotinic signs of acetyl cholinesterase inhibition.[4]

According to the views of Gadoth and Fisher [5] the manifestations are due to nicotinic paralysis. Sedgwick and Senanayake [4] gave a hypothesis that the down regulation of acetyl choline receptors could explain the syndrome and neurophysiological findings of Intermediate syndrome.

Most of the patients have weakness of neck flexor muscles as the initial manifestation followed by weakness of facial, respiratory and

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limb muscles. During the recovery stage, the cranial nerve palsies improves first, followed by improvement in respiratory and limb muscles.[2,6]

The deep tendon reflexes are usually depressed but involvement of pyramidal tract has been reported.[7] Electrophysiological study showed significant decremental response at low frequency stimulation.[8]

Agents commonly causing Intermediate Syndrome are fenthion, monocrotophos, dimethoate, methyl parathion, diazinon, Ethylparathion, malathion, and sumithion.[1,6,9,10.]

Gross reduction of serum cholinesterase in all patients with intermediate syndrome is noted.[6] All the patients who developed intermediate syndrome required mechanical ventillation due to respiratory failure.[11] In a reported study, the incidence of Intermediate syndrome was 29.4% [12]. Methyl parathion was the most common compound. The time taken to recover from the manifestations was 3-12 days. [12]

3. Organophosphate induced delayed polyneuropathy (OPIDN):

OPIDN is a common finding following exposure to organophosphates which have a weak anti cholinesterase activity. Eg. Triorthocresyl phosphate.

OPIDN sets in after a period of 7-21 days of exposure and causes significant morbidity. The earliest symptoms to be seen are paraesthsias and calf pain.[13] Weakness initially appears in the distal leg muscles causing foot drop, followed by small muscles of the hand. Later it may extend proximally and involve the truncal muscles. Gait ataxia is disproportionate to the motor and sensory loss. The cranial nerves and the autonomic nervous system are not involved.[13] Deep tendon jerks are absent.

Clinical involvement of the corticospinal tracts and the dorsal columns become apparent when the peripheral neuropathy improves.

The prognosis of patients with mild neuropathy is good but those with severe neuropathy are usually left with persistent deficits i.e. claw hand, foot drop, persistent atrophy, spasticity and ataxia.[13]

The occurrence of OPIDN appears to follow the phosphorylation and subsequent aging of an enzyme in axons called as neuropathy target esterase.[13] Neuropathy only develops with compounds which are able to inhibit as well as age the neuropathy target esterase enzyme.

4. Chronic organophosphate induced neuro psychiatric disorder (COPIND):

Follow up studies of individuals who have been exposed to high levels of organophosphorous compounds have shown that certain neuro behavioural changes may develop in them, which have been termed together as COPIND.[13] These effects include drowsiness, confusion, lethargy, anxiety, emotional lability, depression, fatigue and irritability.

Some of these symptoms could be attributed to the sequelae of convulsions, anoxia, respiratory failure and cardiac arrhythmias that these patients might have suffered during the acute cholinergic phase.

Chronic neuropsychiatric disorders like anxiety, depressions, problems with memory and concentration have been described in workers exposed to these poisons. In addition, dystonic reactions, schizophrenia, cog-wheel rigidity, choreoathetosis and EEG changes have been reported on high dose exposure. These extra pyramidal symptoms are thought to be due to inhibition of the acetyl cholinesterase in human extra pyramidal area.

Psychosis, delirium, aggression, hallucination and depression may also be seen during recovery from the cholinergic syndrome. Other types of delayed neuro behavioural effects are seen amongst people exposed to low dose of organophosphorous compounds for prolonged periods.

Conclusion

The neurological syndromes of organophosphorous compounds needs a more systematic and methodical approach. The exact extent of these manifestations in clinical practice must be assessed. This would assist in formulating appropriate strategies to manage such cases with available resources. Careful monitoring of these syndromes may positively reduces the morbidity and mortality.

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Review Article

Virtopsy: One Step Forward In The Field Of Forensic Medicine - A Review

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Abstract

Forensic medicine aims for the documentation of medical and other forensic findings in living and deceased persons, for the police and the judiciary system. Though in other branches of the specialty, newer techniques are part of daily routine, in autopsy, the same century old techniques are still being used. Virtopsy is one step ahead in this field which literally means virtual autopsy. New methods like 3D-surface scanning and modern radiological procedures like computed tomography (CT) or magnetic resonance imaging (MRI) are becoming more and more part of scientific research in forensic sciences and are today part of the routine workflow in a some institutes of legal medicine. This paper is aimed to discuss a few points in the field of Virtopsy.

Keywords: *Forensic Radiology, 3D surface scanning, Virtopsy, Virtual autopsy.*

Introduction

Autopsy is the scientific examination of bodies after death, where whole surface of the body as well as all the body cavities are explored to record the findings. While doing so, we have to collect all the possible findings which will help in establishing the circumstances leading to the death and also may help the law enforcing agencies. At the same time, it is also equally important to consider the sentiment of the relatives of the deceased, who are always upset at the conventional autopsies. So, if there exists a means by which all the findings in the body can be collected, it should be accepted by all.

It is long back that the autopsy procedures were invented and till now the same age old techniques for autopsy are being used, though in the other fields of Forensic Medicine, there is rapid growth and advancement in the procedures performed and technology employed. Virtopsy is one step towards this end.

The term Virtopsy came from Virtual autopsy, which is a scalpel free procedure of autopsy carried out using modern medical, imaging and measuring technology[1]. Here, there is no need of any dissection of the body for opening the body cavities or dissection of the different organs of the body. Using the different imaging techniques, which provide a complete three dimensional view of the inside as well as outside of the body, all the vital information like position and dimensions of the wounds, or other pathological conditions in the body can be known and documented without use of any scalpel. The technique could offer an alternative to the standard invasive procedure that upsets many families and is prohibited by some religions, the developers say.

The Virtopsy, or "virtual autopsy" was developed by Richard Dirnhofer, former Director of Forensic Medicine, Berne, which was then continued by his successor, Michel Thali and his colleagues at the University of Berne's Institute of Forensic Medicine, Switzerland. "If you are doing an autopsy, you are always destroying the 3-D geometry of the body," says Thali, the forensic pathologist and project manager for Virtopsy. "Using this cross-section imaging technique, it is possible to document the same findings in a non-invasive way." [2]

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THE IMAGING TECHNIQUES APPLIED:

Whenever a photograph is taken, it always gives a two dimensional view of the particular object. So, if a wound photograph is taken, it will give the position, as well as length and breadth of the wound but can not display the depth of the wound. So for determination of the depth, a three dimensional view of the wound is essential to understand the actual dimensions.

So, in Virtopsy, there is combination of the technologies of medical imaging techniques as well as other technologies used in other field of science.

- 3-D surface scan used in the automobile designing is used to map the exterior of the body. It gives and documents the three dimensional image of the body surface area in details.
- Multi-slice computed tomography (MSCT) and
- Magnetic resonance imaging (MRI) – which visualizes the interior of the body for collection of all the data in details in regards of condition of different organs. One can examine the part of the body slice by slice in different planes according to the requirement of the situation.

Apart from these, using the magnetic resonance imaging spectroscopy, time since death can also be estimated by measuring metabolites in the brain, emerging during post-mortem decomposition. The samples for histopathological examination if required can be collected more precisely using CT guided needle biopsy. Postmortem angiography is used to visualise the cardiovascular system. [1,3,4,5]

DISCUSSION: CONVENTIONAL AUTOPSY VS VIRTOPSY:

Michael Thali and colleagues [5,6] at the University of Berne's Institute of Forensic Medicine, has studied in more than 100 autopsies in Switzerland and the findings of the Virtopsy procedure has matched almost perfectly in side-by-side comparisons with those of the conventional autopsy procedures. The comparisons were checked for a number of forensically pertinent points such as detection of gas, fractures and foreign bodies, as well as tissue and organ trauma.

When teamed with postmortem angiography and biopsy procedures, Michael Thali says that there is little of forensic importance that the virtual autopsy cannot detect. As per Peter Vock, Director of Radiology, University Hospital Berne, [2]the results of the imaging technique in case of cadaver are better, as there is no movement due to the respiratory and cardiovascular activities as in case of the living, which may at times distort the images.

Surface scanner is the means for measuring and depicting the images in three dimensional views with precision. Here, the object is photographed from different angles using digital camera which are then fed in to a computer. The body is scanned from all sides using a sensor which takes pictures using two cameras. The computer then reproduces the image of the body in three dimensional views which can be rotated as per requirement without any distortion for collection of the findings.

In the initial period, In Virtopsy, researchers use only the CT and the MRI for detection of the findings; but in that method, there were limitations as the images formed were only in grayscale, and so many findings were difficult to appreciate. But the new combined method of 3-D/CAD-supported Photogrammetry and the medical imaging technique like the MSCT, MRI etc, give a much better result. Using this merging method of colored photogrammetric surface scan and gray-scale radiological internal documentation, a great step towards a new kind of reality-based, high-tech wound documentation and visualization in forensic medicine is made. The combination of the methods of 3D/CAD Photogrammetry and Radiology has the advantage of being observer-independent, non-subjective, non-invasive, digitally storable over years or decades and even transferable over the web for second opinion. Moreover, by using this method, matching of the weapon of offence or the offending object with the wound can be made.

Using the postmortem angiography, the whole cardiovascular system can be visualised. If there is any injury to a vessel, there will be spillage of the dye to the surrounding tissues, making it visible in the CT images. So, minute injuries to the blood vessels even to a capillary

also can be detected in this method which is usually missed in the conventional autopsy. Apart from that, it is not possible to determine the findings in the heart muscles immediately after an ischemic attack, and so using this technique, the coronary vessels can be better assessed for any occlusion etc. than in case of the conventional autopsy.

Take the example of a bullet injury, the bullet has entered the body through the entry wound and has passed out of the body through the exit wound, leaving the entry and exit wounds as well as the tract of the bullet in the body. Now in conventional autopsies, many a time extensive dissection of the body has to be done to evaluate the path of the bullet, mutilating the body. But by using the virtopsy, all precise information required can be acquired and these can be preserved as digital images. The main advantage of this imaging technique is that the image of the wound or any other findings can be viewed from different angles by changing the viewing angles for better understanding of the findings. Moreover, the body can be viewed in layer by layer, from different angles for better collection of the evidence. Many a time, some findings, as for example, fracture of some bones, which may not be detected in the conventional autopsy, can be better visualised in this technique. [3,7]

Another advantage of this procedure is that, the body is not subjected to any incision, so it is better accepted by the relatives of the deceased. Many a time the relatives of the deceased create hurdles in autopsy procedure on the plea of emotional ground or for religious sentiment. In India, though this is not a problem for the autopsy surgeon, there are many country in this globe, where, autopsy procedure can be avoided if the relatives of the deceased object or do not permit. These people are mostly scared of the mutilation of the body during autopsy and they do not want that any incision to be made on the body. Moreover, the whole architecture of the body is preserved in virtopsy, which is not in case of conventional autopsy; where all the organs are removed and examined. So, if the body is subjected to a second autopsy, it becomes a very tough job for the second autopsy surgeon to come to a conclusion with all the dislodged and dissected organs where the normal architecture is lost. The findings of the Virtopsy are in the digital format, so it can be sent for second opinion to any expert sitting in some distant place in this world. The body can be subjected to second autopsy till it is cremated, even can be examined using the conventional autopsy procedure, if need arises.[1,3,4,6,7]

Again, during autopsy procedure, which involves opening of all the body cavities and dissection and examination of all the organs, there is every chance that infections may be acquired by the mortuary staff as well as the concerned doctor. Nowadays, where newer infecting agents have coming in, it very hazardous in the conventional autopsy as the infectivity from the body is not known and infection can spread from a fresh dead body as well as a highly putrefied body. So, in this aspect, virtopsy is much safer procedure as it does not involve any blood shed or it is a blood less procedure.[4]

Regarding the reliability of the results of the procedure, only comparative study of the cases by virtopsy as well as conventional autopsy can give a correct analysis. R A L Bisset et al[8] has studied in 53 cases at Manchester, UK in the year 1997, using MRI where the findings were confirmed by conventional autopsy. According to their study, the findings were more or less similar in both the methods. In their study, all the cases were non-suspicious deaths referred to the coroner because the general practitioner or hospital doctor could not issue a death certificate or there had been recent surgery or other condition needing automatic referral to the coroner. All the scans were done in private centers and according to this study, they could detect cardiac ischemia, pneumonic consolidations, pleural effusion or pulmonary oedema etc apart from the other cases.

Computed tomography (CT) is the imaging modality of choice for two- and three-dimensional documentation and analysis of autopsy findings including fractures, pathologic gas collections (eg, air embolism, subcutaneous emphysema after trauma, hyperbaric trauma, decomposition effects), and gross tissue injury. Various post-processing techniques can provide strong forensic evidence for use in legal proceedings. Magnetic resonance (MR) imaging has had a

greater impact in demonstrating soft-tissue injury, organ trauma, and non traumatic conditions. However, the differences in morphologic features and signal intensity characteristics seen at antemortem versus postmortem MR imaging have not yet been studied systematically.

Many argue that it is not at all a reliable method in comparison to the conventional method of autopsy. To some extent it is true that in many cases, it is not possible to detect some findings by virtopsy, like a fresh case of MI, where the ischemic changes may not appear at the time of imaging; but here also, as already discussed,

combined with angiography, it gives better result in detection of the thrombotic vessels. Similarly, for collection of the samples, it is not possible by the scanners. Another disadvantage of the procedure is that, recognition of the colour changes which can not be achieved by the technique. More over, there is every chance that some minute findings of tissue injury might be missed, which are easily detectable in conventional autopsy.

SUMMARY:

So, to sum up, virtopsy is a recent advance in the field of investigation in to the cause of death which has many advantages over the conventional autopsy as well as many disadvantages.

Advantages:

- Most effective in study of the wounds including the matching of the probable weapon. The wound can be studied without disturbing the body architecture.
- No scalpel method, so no hazard of infections from the blood or other tissue fluids.
- No mutilation of the body, so, can be examined again without any autopsy artifacts.

The data is stored in digital format, so can be transmitted to any part of the world easily.

- Less time consuming and body can be released immediately after the scanning.
- Better acceptance for the relatives of the diseased and also by the religious customs as incisions not are used.

Disadvantages:

- Insufficient data base of comparative study of virtopsy and conventional autopsy.
- It is not possible to distinguish all the pathological conditions with this technique.
- Can not give the infection status.
- Difficult to differentiate antemortem or the postmortem wounds.
- Difficult to appreciate the postmortem artifacts.
- Difficult to appreciate the colour changes.
- Small tissue injury may be missed.
- In our scenario, it is not possible to provide these types of investigations to all the living persons, so how far it will be practical to start with the same for the dead is questionable, as in our setup, deads come last in the priority list.

Conclusion:

In Japan, postmortem computed tomography (PMCT) has been widely applied for three major roles – (1) screening the cause of death, (2) screening candidates for autopsy, and (3) guidance and/or supplemental information for autopsy. In a study conducted in Japan, questionnaire sheets were distributed, regarding the use of PMCT, to 183 major medical establishments having Emergency Rooms. Of these, 67% responded and it was found that 89% of the respondents use PMCT. This high rate is likely because the number of CTs in Japan is greater than 10,000 units, constituting more than one-third of those in world wide.

So, use of the radiological investigations in the form of CT and MRI etc. are picking up in many places.

So, postmortem radiological examination to detect diseases is a useful tool but it can not replace the conventional autopsy in the present stage. There are differences in the antemortem radiological findings as well as the postmortem findings which need more intensive study. Moreover, there may be postmortem artifacts and it may not be possible to distinguish between the antemortem phenomenon and the postmortem phenomenon which is only possible by naked eye examination and many a time by histopathological or histochemical methods only.

Never the less, it is a new development in the field of investigation of death, but still it has a long way to go to establish itself as an alternative to the conventional autopsy. Its acceptability in the court of law is to proved. But we can hope that in near future, we all will be accustomed to some kind of virtual autopsy or non invasive autopsy technique which will be beneficial for the courts as well as the autopsy surgeons and the relatives of the deceased.

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Supplements

Salient Features: Draft for Approval- Restructured Medicolegal Curriculum for MBBS Course in India [December 2007]

Drafted by " Expert Panel for Revision of Undergraduate Medicolegal Curriculum" and Chaired by Hon'ble Justice M. N. Venkatachalaiah. Submitted to United Nations Development Country Office- SAJI project, Additional Secretary, Ministry of Law and Justice, Department of Justice, Government of India, Secretary, Ministry of Health and Family Welfare, Government of India, President & Secretary of Medical Council of India and all Executive members of medical Council of India who are Forensic Medicine Specialists.

CHAPTER 4: RESTRUCTURED UNDERGRADUATE MEDICO LEGAL

CURRICULUM (FORENSIC MEDICINE & TOXICOLOGY) - 2007

The Medico Legal Curriculum (Forensic Medicine & Toxicology) is being revised/restructured after a gap of 10 years. The following broad principles are adopted for defining the revised/restructured Medico Legal Curriculum.

PRINCIPLES:

- Reduce information overload—stop students from learning unnecessary detail
- Define contents which have relevance even in the future with a focus for the next decade.
- Improve on traditional teaching methods—replace traditional "didactic" teaching with problem-based learning.
- Give students control over their own learning—let students determine what they need to know (and what they wish to be examined in)
- Make undergraduate training a platform for lifelong learning—becoming a Medical Practitioner is only the first stage of continuing medical education of a lifelong career.
- Improve Medical Practitioners' interpersonal communication skills—train students to be empathic and relate better to the patients and their relatives, and their problems.

Learning Objectives

At the end of the course in, Undergraduate Medico legal curriculum (Forensic Medicine& Toxicology), the learner shall be able to: -

1. Identify, examine and prepare report or certificate in medico-legal cases/situations in accordance with the law of land with particular emphasis to
   a. maintenance of medico-legal register like accident register,

b. issuance of wound certificate,
c. issuance of drunkenness certificate,
d. issuance of death certificate
e. Issuance of sickness and fitness certificate
f. estimation of age by physical, dental and radiological examination and issuance of certificate
g. Examination of victims and accused and issuance of certificates in sex related offences.

2. Perform medico-legal post-mortem examination and reasonably interpret autopsy findings and results of other relevant investigations to logically conclude the cause, manner and time since death – especially in accidents, hanging, burns, drowning and poisoning.

3. Preserve and dispatch specimens and other concerned materials in medico-legal / post-mortem cases to the appropriate Government agencies for necessary examination and report.

4. Understand and observe medical ethics, etiquette, duties, rights, medical negligence, medico-social and legal responsibilities of the physicians towards patients, profession, State and society at large.

5. Be aware of relevant legal / court procedures applicable to the medico-legal/medical practice.

6. Deal with basic aspects of diagnosis and management of poisoning (acute & chronic), and develop competence to deal with medico social and medico legal issues arising there from.

7. Recognize and deal with the general principles of environmental, occupational, and preventive aspects of toxicology.

8. Manage medico legal and medico social issues related to Mass disaster including bioterrorism

In other words the focus is on:

- **Knowledge**
  - Identify Medico Legal cases
  - Define responsibilities of physician both medico legal and socio-medical
  - Appreciate physician's responsibilities in criminal matters
  - Describe principles of analytical toxicology
  - Diagnose, manage & document acute/chronic poisonings
- **Skills**
  - Perform, make observations in post mortems/make logical inferences,
  - Prepare proper certificates related to death, Age, wound, fitness and sickness
  - Describe and testify as an expert witness in the Court of Law

- **Integration**

  - To provide integrated approach with other allied disciplines of medicine like pathology, radiology, hospital administration, emergency medicine, dentistry, microbiology, medicine, pharmacology and psychiatry
  - To impart training regarding medico legal responsibilities of physicians at all levels of health care

Course Curriculum:

UNIT I (5th Term) - 20 hours

Themes and Topics

I. Legal procedures
II. Medical law and ethics

Unit II (6th Term) – 65 hours

Themes and Topics

I. Inquest
II. Identification
III. Death and its medico legal aspects
IV. Post mortem changes
V. Medico legal autopsy
VI. Mechanical injuries and wounds
VII. Regional injuries
VIII. Transportation injuries
IX. Injuries/Death from heat, cold, electricity, lightning, Explosives & Radioactive substances
X. Medico legal management of mass disaster including bioterrorism
XI. Mechanical asphyxia
XII. Virginity, pregnancy and delivery
XIII. Sexual offences
XIV. Abortion
XV. Infant and childhood deaths
XVI. Laboratory investigation in medico legal practice:
XVII. Emerging technologies in Forensic Medicine
XVIII. Forensic Psychiatry

Unit III (7th Term) – 35 hours

Themes and Topics TOXICOLOGY

I. General Toxicology
II. Chemical Toxicology
III. Pharmaceutical Toxicology
IV. Bio Toxicology
V. Socio-medical Toxicology

UNIT I (Total 20 hours)

Topic	Time in hours
1. Legal Procedures	
• Define Courts in India and their powers: Supreme Court, High Court, Sessions court, Magistrate's Court, Labour Court, Family Court, Executive Magistrate Court, Labour Court, Juvenile Court • Describe Court procedures Summons, conduct money, oath, affirmation, types of witnesses, recording of evidence, conduct of Medical Practitioner/Medical Officer in witness box • Outline Offences in Court: Perjury; Court strictures vis-a-vis Medical Officer • Demonstrate Medical certification and medico-legal reports	2
• Explain importance of documentation in medical practice – maintenance of patient case records, discharge summary, prescribed registers to be maintained in health centres - maintenance of medico-legal register like accident register, - issuance of wound certificate, - issuance of drunkenness certificate, - Issuance of sickness and fitness certificate - Procedure for issuance of death certificate - Medical Certification of Cause of Death - Form No.4 and 4A - estimation of age by physical, dental and radiological examination and issuance of certificate - Dying Declaration	2
2. Medical law and ethics	**Time in hours**
a. Medical Jurisprudence	
• Definition of Forensic Medicine and Medical Jurisprudence. • Explain Medical Negligence; civil and criminal negligence, contributory negligence, vicarious liability, res ipsa loquitor, prevention of medical negligence and defences in medical negligence litigations	4

• Explain Indian Medical Council (MCI) and State Medical Councils (SMC); Provisions in the Medical Council of India Act 1956; Registration of a medical practitioner – procedure; Functions and disciplinary control of MCI and SMC. • Describe the Consumer Protection Act, 1986; Medical Indemnity Insurance; Civil litigations and Compensations • Describe the legal and ethical aspects of - Euthanasia - HIV and Law - Stem Cell research and cloning	
b. Social aspects and stress management in dealing medico-legal cases	
• Outline the social aspects of Medico-legal cases with respect to victims of rape, attempt suicide, homicide, domestic violence, dowry related cases • Outline the Challenges in Managing medico legal cases - Develop skills in Relationship management – Human behaviour, communication skills, conflict resolution techniques - Outline the principles of handling Pressure – definition, types, causes, sources and skills for managing the pressure while dealing medico-legal cases by the Medical Practitioner/Medical Officer	3
c. Bioethics • Define Medical Ethics and enlist its Historical Emergence • Explain Ethical Principles: Respect for autonomy, non-malfeasance, beneficence, justice • Explain Oath – Hippocrates, Charaka and Sushruta; Modified declaration of Geneva and its relevance; Procedure for administration of Oath – Code of Medical Ethics 2002; • Describe codes of conduct, Professional conduct, Etiquette and Ethics in medical practice • Enumerate rights and privileges and explain duties of a registered medical practitioner, disciplinary proceedings and penal erasure. Ethics 2002; • Describe codes of conduct, Professional conduct, Etiquette and Ethics in	**Time in hours** 2

medical practice • Enumerate rights and privileges and explain duties of a registered medical practitioner, disciplinary proceedings and penal erasure.	
• Explain Medical Practitioner/Medical Officer- patient relationship - Professional secrecy, privileged communication • Rights of a Patient • Explain the legal issues of informed consent: - Types of consent and ingredients of informed consent - Age in relation to consent - In relation to mental illness and alcohol intoxication - Emergency and consent. • Ethical dilemmas in medical profession in relation to consent, treatment and death	5
d. Clinical research & Ethics	
• Human experimentation including clinical trials • Ethical committees • Ethical Guidelines for Biomedical Research on Human Subjects & Animals	2
TOTAL hours	**20**

UNIT – II (Total 65 hours)

Topic	Time in hours
II. Inquest	
• Inquest by Police • Inquest by Magistrate	1
III. Identification	
• Define 'Identification' and enlist the medico-legal aspects related to age • Outline the principles involved in the methods of identification of a unknown living person, dead bodies and remains of a person by age, sex, stature, scars, moles, tattoos, dactylography, foot prints, hairs, poroscopy, DNA typing and personal belonging including photographs and Superimposition techniques, dental examination including Forensic	3

odontology • Outline the procedure and medico-legal formalities of exhumation. • Develop skills in examination of mutilated human remains and skeletal remains.	
IV. Death and its medico legal aspects	
• Define death and its types somatic, cellular and brain-death. • Enlist Natural and unnatural deaths; • Explain issues related to Sudden natural deaths; anaesthetic & Operative deaths • Outline the salient features of the Organ transplantation and The Human Organ Transplant Act 1994. Discuss the ethical issues • Describe and exemplify the conditions of suspended animation.	2
V. Post mortem changes	
• Describe Cooling of body, lividity, rigor mortis cadaveric spasm cold stiffening and heat stiffening • Describe Putrefaction, mummification, adipocere and maceration, • Estimate time of death.	3
VI. Medico legal autopsy	**Time in hours**
• Define medico-legal and clinical/pathological autopsies • Describe the objectives, procedures and formalities of medico-legal autopsies including National Human Rights Commission Protocol	3
VII. Mechanical injuries and wounds	
• Define, classify and differentiate – Abrasion, contusion and laceration • Differentiate simple from grievous injuries • Describe stab wound, incised wound, defence cut, hesitation cuts, self inflicted injuries and fabricated wounds • Differentiate between accidental, suicidal and homicidal injuries. • Identification of the weapon by interpretation of the wound • Explain the causes of death in mechanical injuries • Determine the age of injury • Classify firearms and interpret the findings of firearm wounds. • Explain the medico legal aspects of wounds. • Torture and Human Rights	4

- Define Torture - Identify injuries caused by torture and its sequalae - Management of torture survivors - Outline the National Human Rights Commission guidelines and protocols	
VIII. Regional injuries	
• Injuries of Head, Neck, thorax, Abdomen, Pelvis, Genitalia, Vertebral column and Bones - Enumerate types of skull fracture - Explain coup and counter coup injuries, intra-cranial haemorrhage and injury to brain - Outline the injuries to: spine and spinal cord, thoracic, abdominal and pelvic viscera, bones and joints and their medico legal importance	3
IX. Transportation injuries	**Time in hours**
• Road, Rail & Aviation - State the importance of primary and secondary impact, crush syndrome, Outline the medico legal importance of investigation in road, railway accident and aircraft accident.	2
X. Explain injuries or death due to Heat, Cold, Electricity, Lightening, Explosives & Radioactive substances	2
XI. Explain the medico legal management of mass disasters including bioterrorism	1
XII. Mechanical asphyxia • Define, state causes, enumerate types and describe post-mortem appearances and medico-legal significance of hanging, strangulation, suffocation, traumatic asphyxia and drowning.	3
XIII. Virginity, pregnancy and delivery	
• Describe Sexual and Reproductive Rights of Women in India • Describe medico legal aspects of virginity, pregnancy and delivery • Explain legitimacy and medico legal aspects of pregnancy and delivery including In Vitro fertilisation and Surrogacy • Outline Law on Reproductive Medicine - Impotency - Infertility – Male and Female - Assisted pregnancies and legal problems, surrogate motherhood, hormone replacement therapy and postmenopausal pregnancies • Explain Protection of women from Domestic Violence and Domestic Violence Act 2005 • Describe Pre Conception and Pre Natal Diagnostic Techniques (PCPNDT)	3

(Prohibition of Sex Selection) Act- 2003	
XIV. Sexual offences	**Time in hours**
• Describe the medico legal aspects of Sexual offences and outline sexual paraphilias • Explain the objectives and procedure for examination of victim and accused in case of sexual offence.	3
XV. Abortion	
• Define and classify abortion. • Describe Medical Termination of Pregnancy Act, 1971 with amendment. • Enumerate complications of criminal abortion • Outline investigative procedure in deaths due to criminal abortion	2
XVI. Infant and childhood deaths	
• Define still born, dead born and live born child • Describe the signs of still born, dead born and live born child • Describe the estimation of age of foetus • Describe sudden infant death syndrome • Explain Child sexual abuse and its medico legal implications	2
XVII. Laboratory investigation in medico legal practice:	
• Different types of specimen and tissues to be collected both in the living and dead. - Body fluids - blood, urine, semen, vaginal smear, saliva, Viscera, skull, specimen for DNA, specimen for histopathological examination, blood grouping and DNA finger printing in disputed paternity and maternity • Methods of sample collection, preservation, labelling, dispatch, and interpretation of reports	2
XVIII. Emerging technologies in Forensic Medicine	**Time in hours**
• Outline the principle and medico legal importance of : - DNA profiling - Polygraph (Lie Detector) - Narco analysis, - Brain Mapping, - Digital autopsy, - Virtual Autopsy, - Imaging technologies	2
XX. FORENSIC PSYCHIATRY	
• Classify common mental illnesses including post traumatic stress disorder	4

(PTSD) • Define, classify and exemplify – Delusions, hallucinations, illusion, lucid interval and obsessions. • Describe the civil and criminal responsibilities of a mentally ill person • Differentiate true insanity from feigned insanity. Who can certify 'Insanity' • Comment on delirium tremens. • Explain testamentary capacity and restraint of an insane. • Outline the Indian Mental Health Act, 1987 with special reference to admission, care and discharge of a mental ill person.	
PRACTICALS	20
TOTAL hours	65

UNIT III (Total 30 hours)

Topic	Time in hours
TOXICOLOGY	
XXI. General Toxicology	
• Describe the general principles of diagnosis and management of - Common poisons encountered in India, General symptoms of poisoning, simple bedside tests to detect poison/drug in a patient's body fluids, Basic methodologies in treatment of poisoning: decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination, etc. • Explain the medico-legal considerations in case of suspected poisoning - Procedure of intimation of suspicious cases or actual cases of foul play to the police, maintenance of records, preservation and despatch of relevant samples for laboratory analysis. • Outline the general principles of Analytical Toxicology and give a - Brief description of analytical methods available for toxicological analysis: Chromatography – thin layer chromatography, Gas chromatography, Liquid chromatography and Atomic Absorption Spectroscopy.	5

XXII. Chemical Toxicology	
• Describe the clinical features, fatal dose, fatal period, management, post mortem appearance and medico legal aspects of poisoning by: i. Caustics Inorganic – sulphuric, nitric, & hydrochloric acids Organic – carbolic acid (phenol), oxalic, and acetylsalicylic acids ii. Inorganic Elements Phosphorus, Iodine, Barium iii. Heavy Metals Arsenic, lead, mercury, copper, iron, cadmium, thallium iv. Alcohols Ethanol, methanol, ethylene glycol v. Hydrocarbons and Pesticides a) kerosene, petrol, benzene, methane, turpentine b) Organophosphates, carbamates, organochlorines, pyrethroids, paraquat, aluminium and zinc phosphide vi. Toxic Gases *Ammonia, carbon monoxide, hydrogen cyanide & derivatives, methyl isocyanate, tear (riot control) gases and War gases*	11
XXIII. Pharmaceutical Toxicology	
• Describe the clinical features, fatal dose, fatal period, management, post mortem appearance and medico legal aspects of poisoning by: i. Antipyretics – Paracetamol, Salicylates ii. Anti-Infectives Common antibiotics – an overview iii. Neuropsychotoxicology Barbiturates, benzodiazepines, phenytoin, lithium, haloperidol, neuroleptics, tricyclics iv. Narcotic Analgesics, Anaesthetics, and Muscle Relaxants v. Cardiovascular Toxicology Cardiotoxic plants – oleander, odollam, aconite, digitalis vi. Gastro-Intestinal and Endocrinal Drugs – Insulin	7
XXIV. Bio Toxicology	
• Describe the clinical features, fatal dose, fatal period, management, post mortem appearance and medico legal aspects of poisoning by: i. Poisonous Plants Castor, croton, calotropis, abrus, datura, strychnos ii. Food Poisoning & Food Adulterants Bacterial, viral, chemical food poisoning, toxic mushrooms and fish, Argemone iii. Venomous Bites and Stings Snakebite, scorpion sting, bee & wasp sting, spider bite.	6

XXV. Socio-medical Toxicology	
• Describe the clinical features, fatal dose, fatal period, management, post mortem appearance and medico legal aspects of poisoning by: i. Substances of Dependence and Abuse Tobacco, cannabis, amphetamines, cocaine, hallucinogens, designer drugs & solvent abuse • Enlist salient features of NDPS Act.	2
PRACTICALS	4
TOTAL hours	**35**

SKILLS TO HANDLE MEDICO LEGAL ISSUES

Skills	Able to perform independently	Able to perform under guidance	Assist	Observe
1. Prepare proper certificates of birth and death	+			
2. Prepare dying declarations	+			
3. Give evidence in a court of law as an expert witness	+			
4. Collect and do proper labelling preservation and dispatch of medico-legal specimens.	+			
5. Diagnose and manage common acute and chronic poisonings .	+			
6. Perform the medico-legal duties in case of poisoning and log 5 cases in the record book	+			
7. Observing of ten medico-legal autopsies* and enter the reports in practical record.				+
8. Age estimation from bones, x-rays and dentition		+		
9. Examination of injuries, weapons and report writing, Draft informed consent form	+			
10. Examination of an alcohol intoxication person & report writing	+			
11. Examination of victim & accused in sexual offences and report writing	+			
12. Study of specimens of poisons		+		
13. Perform simple bedside tests in poisoning	+			
14. Study of wet specimens during autopsy	+			

* Medical colleges not having autopsy facilities can depute the students to the nearest Government/Civil hospital

Course Regulations

Course duration

A total teaching time of 120 hours may be allotted for transacting the Medico Legal Curriculum (Forensic Medicine & Toxicology).

Course schedule

The principle of integration is the basis for scheduling the course contents. The topics and the timing of Medico Legal Curriculum (Forensic Medicine & Toxicology) teaching should integrate with the knowledge the students have with respect to Anatomy, Physiology, Pathology, General Medicine, General Surgery and Obstetrics and Gynaecology.

TERM	CONTENTS	HOURS
5th term	History of Medicine and behavioural science, Medical ethics, medical etiquette, theoretical aspects of medical jurisprudence, court procedures,	20 hours
6th term	Theoretical aspects of injuries, shock, haemorrhage, asphyxia, post-mortem procedures, death and post-mortem changes and identification, sexual offences, medical termination of pregnancy, infant deaths, Forensic psychiatry,	65 hours
7th term	Toxicology	35 hours

Methods of instruction:

A. This course is operated on a lecture, discussion, practical including demonstration and student participation format.
B. Students may be required to present selected materials to the class.
C. Structured problem based exercises may be provided to simulate specific case examples.
D. Audio visual material and/or printed handouts will supplement reading and classroom instruction.
E. Exposure visit to:

Mandatory:

a. Court –
    i. Criminal [expert testimony of homicides]
    ii. Consumer [medical negligence cases]
b. Casualty department

Desirable

a. Forensic Science laboratory – toxicology and ballistics
b. Crime Scene
c. Exhumation
d. Prison

Methods of learning:

a) Read and study assigned and/or recommended readings.
b) Participate in class discussion.
c) Participate in group interaction and ask questions of lectures.
d) Seminars by students
e) Complete required assignments.
f) Practicals – hands on laboratory work

- Fingerprinting
- Clinical Forensic Medicine cases
- Moot courts
- Documentation: Clinical examination of patients/victims
- Visit to Crime scenes: Inquest by police, Magistrate,
- Collect, Pack, Label, Transport evidences
- Visit to Casualty: Poisoning cases [Emergency Management] - Documentation of 5 poisoning cases
- Visit to Casualty/Inpatient wards

Methods of assessment:

Internal assessment programme:

1. Periodic objective/Problem based Tests – One at the end of each term
2. Activity – Case studies/ Seminars/ Individual and group assignments
3. Research Activity like projects with support from Department of Health Research, Government of India
4. Practical
5. Structured Oral Viva Voce

Internal assessments (a minimum of 3 in number) should be held in the 5^{th}, 6^{th} and 7^{th} term in other areas of Forensic Medicine.

Evaluation:

At the end of seventh term of M.B.,B.S., TWO papers of theory examination, one practical examination and viva voce to be conducted.

Paper 1 – Forensic Medicine and Forensic Psychiatry – 3 hours
Paper 2 – Medical Jurisprudence and Toxicology – 3 hours

The mark distribution for theory examination would be: Forensic medicine 40 percent; Medical Jurisprudence 20 percent; Toxicology 30 percent; Forensic psychiatry 10 percent. The total marks for the Medico legal curriculum (Forensic Medicine and Toxicology) would be 300. The distribution would be as below:

Details of assessment	Marks
Theory Paper 1	80 (Forensic Medicine 70 + Forensic Psychiatry – 10)
Theory Paper 2	80 (Medical Jurisprudence 35 + Toxicology – 45)
Internal Assessment - Theory	20
Practical Examination	80
Internal Assessment – Practical	20
Viva Voce	20
TOTAL	**300**

The assessment method to include essay question, Microscopic examination, Short answer questions, MCQs. Problem solving exercises, Objective and Structured Clinical Examination (OSCE), Objective and Structured Practical Examination (OSPE), Records Review, Checklist and Structured Oral Viva Voce.

In practical examination, the distribution of the marks shall be as follows:

i. Spotters – 10 marks
ii. Age estimation of subject – 10 marks
iii. Age estimation using X-ray and issue of age certificate – 10 marks
iv. Examination and report of bones – 10 marks
v. ANY FOUR of the following exercises – 10 marks each
    a. Medical Certification of cause of Death
    b. Medico legal autopsy report
    c. Sickness and Fitness certificate
    d. Examination and certification of injured
    e. Examination of a case of drunkenness
    f. Examination of a case of simulated poisoning

The marks obtained in the internal assessments should be considered along with the final marks obtained in the theory and practical examination.

Passing:

A candidate must obtain 50 percent in aggregate with 50 percent in Theory + Viva Voce (minimum of 40% in theory), & 50 percent in practicals.

Internship:

Rotating Internship postings of 15 days to the Medico Legal department *(Forensic Medicine department)* to be mandatory for all interns. The postings shall include working in the Mortuary, casualty, handling Clinical forensic Medicine Cases and attending court. During the posting the candidate should assist minimum of TWO Medico Legal Autopsies and perform ONE medico legal autopsy under guidance. Medical colleges not having autopsy facilities can depute the interns to the nearest Government/Civil hospital.

Learning Resource Material

Suggested **textbooks** for Forensic Medicine and Toxicology

1. Principles of Forensic Medicine, Apurba Nandy, New Central Book Agency (P) Ltd., 2nd Edition 2000, Reprint 2005
2. Parikh's Text book of Medical Jurisprudence, Forensic Medicine and Toxicology for Class room and Court room, CK Parekh, CBS Publishers and Distributors, 6th Edition 1999, Reprint 2007
3. Textbook of Forensic Medicine & toxicology – Kishan Vij, Elsevier Publication, New Delhi
4. The Essentials of Forensic Medicine & Toxicology, K.S. Narayan Reddy, K Suganadevi, Malakpet, Hyderabad, 26th Edition, 2007
5. Text book of Forensic Medicine and Toxicology, V.V.Pillay, Paras Medical Publishing, Hyderabad, 15th Edition
6. Fundamentals of Forensic Medicine and Toxicology, R.Basu, Publishers-Books and Allied (P) Ltd., Kolkota.
7. Text book of Forensic Medicine, Toxicology and medical Jurisprudence, Dr. B.V. Subrahmanyam, Modern Publishers, Gulab Bhawan, 6 Bahadur Shah Zafar Marg, New Delhi – 110 002.

Reference Books

1. Text Book of Forensic Medicine, J.B. Mukherjee Vol 1 & 2
2. Cox's Medical Jurisprudence & Toxicology, Bernard Knight et al
3. Modi's Medical Jurisprudence and Toxicology, K.Mathiharan and A.K.Patnaik, Easten Book Company, Lucknow, 23rd Edition,
4. Knight's Forensic Pathology, Pekka Saukka and Bernard Knight Arnold Publication London, Co-published by Oxford Publications, USA, 3rd Edition
5. Taylor's Principles & Practice of Medical Jurisprudence, A.Keith Mant, Churchill Livingstone.
6. Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations 2002
7. Lyorn's Medical Jurisprudence and Toxicology, Dr. Dogra, T et al.
8. Comprehensive Medical Toxicology, VV Pillay. Paras Medical Publisher, Hyderabad.

ANNEXURE

Annexure 1: Members of the Expert Panel

Sl No	Name	Organization
1.	Justice M. N. Venkatachalaiah, **Chairperson**	Former Chief Justice of India, Former Chairman National Human Rights Commission, India
2.	Prof. P. K. Devadass	Head, Department of Forensic Medicine, Bangalore Medical College and Research Institute, Bangalore
3.	Dr. Karunakaran Mathiharan	Advisor, Institute of Legal Medicine, Chennai, Hon. Director, Rehabilitation Centre for Torture Victims (RCTV), Madurai
4.	Mr. Henry Tiphagne	Lawyer and Executive Director, People's watch Tamil Nadu
5.	Dr.(Flt Lt).M.A.Balasubramanya	Anaesthesiologist and Secretary, Swami Vivekananda Youth Movement, Mysore, Karnataka
6.	Dr.V.Raju	District Surgeon, Mysore
7.	Mr Thimmanna Naik	Public Prosecutor, Mysore
8.	Dr.Chandrashekar Kapse	Professor and Head, Department of Forensic Medicine BLDE Medical College, Bijapur, Karnataka

Annexure 2: Members of the National Technical Review Panel

Sl No	Name	Organization
1.	Justice M. N. Venkatachalaiah, **Chairperson**	Former Chief Justice of India, Former Chairman National Human Rights Commission, India
2.	Dr. S. Krishnamurthy	IPS (Retd.), Bangalore
3.	Dr Indrajit Ray	Professor of Forensic Medicine, Principal, Medical College, Kolkata and Chairman, Ethics Committee and Member, Post Graduate Medical Education Committee, Medical Council of India, New Delhi.
4.	Dr T. D. Dogra	Professor and Head, Department of Forensic Medicine, All India Institute of Medical Sciences, New Delhi
5.	Mr P.G.Nadagouda,	Principal District and Sessions Judge, Haveri District, Karnataka
6.	Dr. V. V. Pillay	Chief, Poison Control Centre, Head, Analytical Toxicology & DNA Typing, Professor, Forensic Medicine & Toxicology, Amrita Institute of Medical Sciences, Cochin, Kerala
7.	Dr.Pramod Bagali	Senior Scientist (Forensic Medicine) & Director, Digital Autopsy Project, INFOVALLEY, Kuala Lampur, Malaysia

Supplements

Andhra Pradesh Ordinance Against the Violence on Doctors and Medical Establishments

The Andhra Pradesh Gazette- Part IV-B Extra ordinary

Published by Authority

No.59 Hyderabad, Tuesday, December 18, 2007

Andhra Pradesh Acts, Ordinances Regulations Etc.

The following is the authoritative text in English Language of the ordinance Promulgated by the Governor on the 18th December, 2007 is being published Under article 348(3) of the Constitution of India for general information.

Andhra Pradesh Ordinance No.16 of 2007.

Promulgated by the Governor in the Fifty-eight year of the Republic of India.

An ordinance to Prohibit Violence Against Medicare Service Persons And Damage to Property In Medicare Service Institutions And For Matters Connected Therewith and Incidental Thereto.

2. Andhra Pradesh Gazette Extraordinary (Part IV-B)

Whereas, acts of violence of causing injury or danger to life of Medicare service Persons and damage to property of Medicare service Institutions are on the increase in the State Creating unrest in Medicare professionals resulting in total Hindrance of such services in the State;

And whereas, it has become necessary to prohibit such Violence activities by making the offences as cognizable and non-bailable;

And whereas the Legislature of the State is not in Session and the Governor of Andhra Pradesh is satisfied that Circumstances exist which render it necessary for him to take Immediate action;

Now, therefore, in exercise of the powers conferred by clause (1) of article 213 of the Constitution of India the Governor Hereby promulgates the following Ordinance: -

1. (1) This ordinance may be called the Andhra Pradesh Medicare *Short title,*

Service persons and Medicare Service Institutions *extent and*
(Prevention of Violence and Damage of Property, Ordinance,2007) *Commencement*

(2) It Extends to the whole of the State of Andhra Pradesh.

(3) It shall come into force at once.

2. In this Ordinance, unless the context otherwise requires;

(1) 'Medicare Service Institution' means all institutions providing *Definitions*
medicare to people which are under the control of State of Central Government or Local Bodies etc., including Any private hospital Having facilities for treatment the sick and used for their reception or stay; any private maternity home.

Where women are usually received and accommodated for the Purpose of confinement and antenatal and post-natal care in connection with child birth or anything connected therewith; and any private nursing home used for intended to be used for the reception and accommodation of persons suffering any sickness, injury or infirmity whether of body or mind, and providing of treatment for nursing or both of them and includes a maternity home or convalescent home, etc.,

(2) 'Medicare service persons in relation to medicare service institution' shall include,-

(a) Registered Medical Practitioners, working in Medicare Institutions (including those having provisional Registration;
(b) Registered nurse;
(c) Medical students;
(d) Nursing students;
(e) Practical workers employed and working in Medicare Service Institutions.

(3) 'Offender' means any person who either by himself or as a member or as a leader of a group of persons or organization commits or attempts to commit or abets or incites the commission of violence under this Ordinance.

(c) ' Violence ' means activities of causing any harm, injury or endangering the life or intimidation, obstruction or hindrance to any medicare service person in discharge of duty in the medicare service institution or damage to property in medicare service institution.

(4) Andhra Pradesh Gazette Extraordinary (Part IV-B)

3. Any act of violence against medicare service person or damage *Prohibition*
to property in a Medicare service Institution is hereby prohibited. *of violence*

4. Any Offender who commits any act in contravention of Section 3, *penalty*
shall be punished with imprisonment for a period of Three years and

with fine, which may extend to fifty thousand rupees.

5. Any offence committed under Section 3, shall be cognizable and non Bailable. *cognizance of Offence*

6.(1) In addition to the punishment specified in section 4, the offender shall be liable to a penalty of twice the amount of purchase price of medical equipment damaged and loss caused to the property as determined by the Court trying the offender. *recovery of loss for the damage Caused to the property*

6.(2) If the offender has not paid the penal amount under sub-section (1), the said sum shall be recovered under the provisions of the Andhra Pradesh Recovery Act, 1864 as if it were an arrears of land revenue due from him.

7. The provisions of this Ordinance shall be in addition to and not in derogation of the provisions of any other law, for the time begin in force. *Ordinance not in derogation of any other law*

Narayan Datt Tiwari
Governor of Andhra Pradesh

T. Madan Mohan Reddy
Secretary to Government
Legislative Affairs & Justice
Law Department

GUIDELINES TO AUHTORS/ CONTRIBUTORS

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