

APRIL-JUNE,
2009

Vol. LVI-No.2



IJD

The Indian Police Journal



Terrorism



The Indian Police Journal

Vol. LVI-No.2 April-June, 2009

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Gopal K. N. Chowdhary

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Editorial

The spectre of terrorism has been haunting world in general and India in particular for last few decades. It has come to forefront in new millennium with “Cataclysmic” terrorist attack on USA in September, 2001, what is known as 9/11. Though our country has been subjected to series of terrorist attacks for more than two decades, resulting from our neighbours pursuing terrorism as instrument of state’s policy, it caught Nation’s attention in wake of attack on Parliament on 13 December, 2002.

The Mumbai attack last year shook not only the entire India but its tremors were felt across the world. However, there are some positive trends as far as terrorism and its containment is concerned. According to RAND-MIPT, while there is no “upward trend in the international incidents of terrorism, domestic terrorist incidents are much more numerous than international incidents.”

Despite this optimism, terrorism has no borderline and it is very difficult to categorise it as international and domestic incident wise. Even so called domestic incidents have international inputs and players, as was the case in Mumbai attack and even international incidents may be viewed or aimed at domestic constituency as was the case in the 9/11. Even London or Madrid or Lahore attack may be termed international as well as domestic.

It is akin to terming and classifying ‘good’ and ‘bad’ terrorist as is being done by some nations to suit their geo-political interests. This kind of approach is not going to help in curbing terrorism. Terrorism has both domestic and international ramifications, as well as players and inputs. It is misnomer to categorize it into domestic and international or ‘good or bad’ or ‘freedom-fighter’ or ‘Jehadi’.

The terrorism must be seen as terrorism, nothing else whatever justification or provocation may be. A terrorist is a terrorist, terrorism is terrorism, whether domestic or international or good or bad. This compartmentalized approach to terrorism has done much harm to our campaign against terrorism and has demoralized our forces and policy makers.

Moreover, we must act ourselves instead of hoping that some other nation shall do our bidding in containing terrorism. If we continue to try half-hearted measures to contain terrorism, we shall get what we have been getting so far ‘sympathy’, ‘hyperbole,’ ‘empty promises’ ‘sermons on patience’. Meanwhile we will continue to bleed profusely.

Another misnomer regarding terrorism is containment vs engagement. The terrorist must be contained, engagement would give them time and breathing space to regroup as happened in case of Taliban and terrorist or insurgents operating in North East. Engagement as policy succeeds when the actor is rational to some extent and is open to some sort of negotiation and dialogues.



However, we must formulate long-term as well short-term strategy to contain terrorism. Moreover, we should be prepared to sacrifice short-term gain for long-term windfall so far terrorism is concerned. Apart from implementing Police Reform and Police Modernization, there should be concerted efforts to involve community and society in this campaign. The coalescing and synergization of other stakeholders is a must for this purpose.

In this issue of IPJ (April-June 2009), some aspects of terrorism have been dealt with. Brigadier M.S. Khara, in his paper, 'Community Participation in Security against Terrorism' discusses how act of terrorism can be averted by active participation of community. The paper discusses the modus operandi of terrorist groups and various tell-tale signs which would enable common man to detect a terrorism activity about to take place.

The paper urges for active community participation in checking terrorism.

Sh. Rajnish Rai, IPS, in his article, 'Microeconomic Analysis of Terrorism' presents theoretical aspect of terrorism. He maintains that the direct role of economic factors such as poverty and inequality and policy measures such as sanctions is one way of looking at the issue of terrorism. However, these measures are incomplete. "It is also important to look at how terrorism affects behaviour, how economic concepts can help us understand the behaviour of individuals and organizations that employ the tools of violent terrorism. The utility maximization model provides insights into both terrorist resource allocation choices and counterterrorism efforts, while basic game theory helps characterize the strategic interdependencies among terrorists and governments"

Apart from these two papers on terrorism, other aspects of policing such as forensics ('Advancing Fronts in Forensics' by B.R. Sharma, 'Snake Bite Poisoning – A Forensic View' by Dr. Mithilesh Jha, Dr. A.K. Jaiswal & others, 'Evidence through Scientific Aid' by Dr. Sahib Singh Chandana and 'Forensic Odontology and Human Identity' by Dr. J.R. Gaur) Correctional administration ('Astray Socialization of Children in Prison' by Dr. Deepti), Criminal Justice system ("Plea Bargaining in India" by Dr. Abhimanyu Behra) Money Laundering ('Drug Trafficking as a Source for Money Laundering by Dr. M. Shrinivasan,) and Left wing Extremism ('Firearms Used by Naxalites: A Forensic Study' by Dr. Swaroop Vedanand, Mr. C. Narayan Rao & Mr. O.N. Murthy) have been discussed.

We hope that our esteemed readers would be benefited from these articles. The comments and suggestions are welcome

Gopal K.N. Chowdhary
Editor

Abstracts & Key Words

Community Participation in Security against Terrorism

Brig. M.S. Khara

Key Words

Community Participation, Vehicle Borne Explosive Device, Special Events Location, Neighbourhood Watch Scheme, Eyes and Ear Scheme, Intelligent Video cameras

Abstract

The fast deteriorating security environment in the country has put tremendous pressure on the Police Forces to maintain normal law and order and also to simultaneously face the growing threat of terrorism. To overcome this problem, there is a requirement of motivating the common man to carry out policing duties in their normal routine activities. This huge potential of our masses lying unexploited so far, once unleashed, shall create an environment where no militant dares to carry out any kind of terror activity without being caught. The paper gives out the modus operandi of terrorist groups and various tell-tale signs that shall enable common man to detect a terror activity about to take place. It also lists out the duties of each strata of our society, including school going children and also gives out the roles of local organizations to create a mass movement of security conscious people to keep the areas around them sanitized. Market committees and Mall owners have a very important role in preventing any terror related activities in crowded commercial spaces. The optimization of Private Security Agencies and use of Intelligent Security Cameras in Public Places will further reduce the load on Police Resources from normal law and order problems and concentrate on anti-terror operations. Methods of creating mass awareness that shall bring home the point to a large population has also been dealt with in this paper in detail.

Microeconomic Analysis of Terrorism

Rajnish Kumar Rai

Key Words

Terrorism, Rational Choice Model, Game Theory, Prisoner's Dilemma, Public Goods

Abstract

Sociologists and economists have mostly discussed the links between terrorism and economics in terms of how poverty, inequality, and limits on opportunity, because of skewed government policies shape terrorist responses, and on how the alleviation of these conditions might reduce the acts of terrorism. The direct role of economic factors, such as poverty and inequality, and of policy measures, such as sanctions, is one way to examine the economics of terrorism. But these measures are incomplete. It is also important to look at how terrorism affects behaviour, how economic concepts can help us understand the behaviour of individuals and organizations that employ the tools of violent terrorism, and how economic concepts can help formulate tools to combat terrorism. The utility maximization model provides insights into both terrorist resource allocation choices and government counterterrorism efforts, while basic game theory helps characterize the strategic interdependencies among terrorists and governments.

Advancing Fronts in Forensics

B.R. Sharma

Key Words

Forensics, Crime Scene, Video Recording of Scene, Virtual Reality, Computer Graphics; Scientific Interrogation, Forensic Psychology, Psychological Detection of Deception, Narco-Analysis, Lie Detector, Brain Printing, Scientific Surveillance Tools, Sound Surveillance, Optical Surveillance, Tracking Devices; Forensic Analysis, DNA Profiling,



Scanning, Electron Microscopy, Spectroscopy, Chromatography, Pattern Recognition, Computers; Pre-emption, Pre-emption tools, E-trade, E-frauds, Tele-marketing, Power Presentation, Virtual Reality, Animation Films.

Abstract

Forensics has made significant progress in all aspects of handling crime. Its advancing fronts are: Better handling of crime. Advances pertain to participation of the scientist in the evaluation of the scene, in the video recording of the scene, locating and collecting the correct clues and their on spot evaluation; and in creating Virtual Reality of the scene and occurrence through animation films. Forensics provides tools like Lie Detector, Brain printing and Narco-analysis for interrogation which are giving excellent result in finding the truth. They also dispense with the illegal and inhuman third degree methods. Scientific tools for surveillance are working wonders to locate, track and apprehend the criminal. Clue material analyses have undergone a sea change. Now the tiniest clue material can be analysed, identified and compared. Tools and techniques like DNA profiling, Scanning Electron Microscopy, Spectroscopy, Pattern Recognitions, etc., with computers as their workhorse, have brought in the revolution in clue analyses. In addition, new tools for pre-emption, power presentation of evidence, creation of virtual reality, etc along with the above mentioned tools and techniques augur a new life-support to the tottering criminal justice system. It is hopefully believed and prayed that the new generation of tools and technique ensure and expedite the dissemination of justice.

Snake Bite Poisoning - A Forensic Review

Mithilesh Jha, A K Jaiswal, T. Millo & M Gupta

Key Words

Snake, Snakebite, Venom, Colubrine, Viperine, Antivenin, Fangs, Detection, Analysis, Site of Bite

Abstract

In the present article, an attempt has been made to review snake bite poisoning cases. It provides detailed facts about the morphological identification features of poisonous and non-poisonous snakes,

clinical symptoms and signs, chemistry of venom, management aspects, autopsy findings, sample collection, detection of venom and its medico-legal significance. This article will be of great help to the practising physicians, autopsy surgeons and forensic toxicologists.

Evidence Through Scientific AID

Dr. Sahib Singh Chandna

Key Words

FSL (Forensic Science Laboratory), I.O.(Investigating Officer), P.S. (Police Station), Burglary, Suicide, Homicide, Murder, Crime Investigation, Physical Clues, Modus Operandi, Biology, Dowry Death, Asphyxia.

Abstract

To begin, it is important to recognize that there are certain fundamental principles of crime investigation for which there are really no alternatives. Circumstantial evidences/physical clues can be regarded as spokes on a wheel. If even one spoke is weak, the wheel will not run smoothly and the entire vehicle will be disrupted. In the similar way, entire system of crime investigation and presentation of truthful physical evidences in the Court will collapse in absence of even a single significant clue, when we fail to determine the principles underlying crime investigation. The level of stress under which the investigating agency has to work is coupled with periodic conventional evaluation proceeding with help from scientific personnel. Positive, optimistic and peaceful trend and coordination of investigating officers in proper crime investigation is based on the quality of scientific aid, screening, orientation, collection and examination of well-protected physical clues from the place of occurrence. It would be imperative to point out that state of mental-emotional patterns such as resentment, envy, fear and guilt can disrupt and disorder the process of investigation to a larger, extent. Modern science has substantiated the fact that every emotional touch is beset with innovative theory of investigation coupled with the help sought from forensic science personnel, who exerts a beneficial influence in streamlining the modern line of investigation. It would be more wise to consult the professional scientists from Forensic Science Laboratory for an appropriate approach in

Abstracts & Key Words

crime investigation followed by screening, collection, transportation, storage and examination of physical clues in an appropriate manner to present case reports in Courts for onward process of justice as Forensic science is the most important pillar of rustic delivery system these days

Forensic Odontology and Human Identity

Dr. J. R. Gaur

Key Words

Forensic Science, Forensic Odontology, Fingerprints, Identity, Crime Investigation, Justice.

Abstract

Forensic Science is as old as human civilizations. Evidences regarding the use of finger, palm and sole prints as seals are depicted in some of the pre-historic cave paintings all over the world, indicating that even in those times man had the knowledge that by using these evidences he could keep separate the paintings made by him from others. In China and Assyria respectively in 3rd and 7th century B.C., people used fingerprints so as to keep separate identity of their articles. The various branches of forensic science gradually developed in the world upto 19th century and it was in the year 1897 that the first fingerprint bureau of the world was established in Kolkata after Sir Edward Henry, Hem Chandra Bose and Khan Bahadur wrote a book on the classification of fingerprints. Subsequently, the oldest handwriting bureau in India was established as GEQD, Shimla in the year 1904. The Twentieth century has been the age of science as there have been tremendous scientific developments in the world. Enormous development of forensic science institutions took place in the world in the 20th century itself, and at present we have about 34 forensic science laboratories in India, 28 fingerprint bureaux and more than 120 departments of forensic medicine in various medical colleges in the country. At present, more than 3500 forensic science laboratories stand established in the world. The science of forensic odontology also developed in the 20th century all over the world, but, in India, it progressed only during the last two decades of the 20th century and is progressing leaps and bounds in the 21st century with the establishment of more dental colleges in the Government and private sector. The importance of forensic

odontology in crime investigation and administration of justice shall be highlighted in the present paper with examples of a few important cases. What important parameters we should consider in forensic odontology for establishing identity shall be discussed in this presentation.

Astray Socialization of Children in Prisons

Dr. Deepti Shrivastava

Key Words

Astray - Off Track, Socialization - Process of Social Learning, Peer Group - Other Social Groups, Secondary Groups-School, Play Groups, Neighbors

Abstract

Children whose mother have been arrested and incarcerated face many kinds of difficulties. The imprisonment of a mother for her children leads to a series of rapid changes in the lives of both mother as well as their children. This is certainly one of the worst aspects of imprisonment. As we know the nation's children are an extremely significant asset. Their look after and concern for proper socialization are our responsibility. Children's healthy socialization should find outstanding element in our countrywide strategy for the growth of human resources, so that our children nurture up to turn into full-bodied resident, bodily fit, psychologically alert and morally healthy, gifted with the talent and inspirations endowed with society. Equivalent prospects for progress to all children throughout the phase of development should be our aim, for this would serve our larger purpose of reducing dissimilarity and ushering in social justice. By socialization point of view this is a very decisive face of Children. A child socialized with the help of different agents of socialization which is not available in prisons adversely affects the child development. Consequently children accompanying women prisoners are going astray of it. Present paper examines this problem and suggests some remedies.



Plea Bargaining in India

Dr. Avimanyu Behera

Key Words

Plea Bargaining, Mutual Disposition, Pre-trial Negotiation, Slow Motion Syndrome, Sentence Bargaining

Abstract

The term 'plea-bargaining' is used to cover different things. It is sometimes used to describe discussions between prosecution and an accuser's legal advisers concerning the charges upon which an accused will be presented for trial, including indications that the accused is prepared to plead guilty to certain offences. This may be described as prosecutorial plea-bearing. The term also covers discussion in which the trial judge takes part. In such an arrangement counsel for the accused and the prosecution attend the Judge in his private Chamber and discuss with the Judge the probable sentence of the accused who, through his counsel indicates that he will plead guilty. This may be described as Judicial Plea-bargaining.

Drug Trafficking as a Source for Money Laundering

Dr. M. Srinivasan

Key Words

Money Laundering, Drug Trafficking, Drug Abuse

Abstract

Money laundering is the process of converting cash, or other property, which is derived from criminal activity, so as to give it the appearance of having been obtained from a legitimate source. There are various criminal activities that generate money laundering. Drug trafficking is also becoming one of the major sources of generating money laundering in India. Based on the approximate cost of the drugs, the total money involved in the drugs that were seized during the year 2006 was computed by the author. This rough estimate shows that more than 89 crores of rupees were involved. If, the drugs which do not result into seizure and successfully marketed are roughly around 10 times of the size of the seized drugs, are calculated, the money

involved would have been around 890 crores of rupees. Hence, in the present paper, attempts have been made to address the key issue, namely how does drug trafficking become a source for money laundering in India.

Firearms Used by Naxalites: A Forensic Study

Dr. Swaroop Vedanand, Mr. C.Narayana Rao, and Mr. O.N.Murthy

Key Words

Naxalites, Firearms, Ammunition, Country Made Firearms, Andhra Pradesh.

Abstract

Over one-third of India is affected by Naxalite violence. Naxalism and terrorism are the two big threats to India's internal security. The Naxalite ideology - "governance only through the barrel of a gun" and their activities have posed a law and order problem in India. The present study deals with the type of firearms used by the Naxalites in Andhra Pradesh. A statistical data of firearms and ammunition which are seized from the Naxalites and are sent to APFSL for examination during the year 2001 to 2005 is presented in this paper. The data clearly indicate that there were more cases in Telengana region when compared to other two regions i.e. Rayalaseema and Coastal Andhra in Andhra Pradesh. In Telengana region, Warangal district is at the top in respect of number of firearms seized. Apart from regular firearms that are available in India, various kinds of special caliber firearms that were seized from the Naxalites are presented. The statistical data indicate that Naxals are using predominantly 8mm rifles and 12 bore shot guns which are more in number when compared to other firearms because of the easy availability of their ammunition. Country made Revolvers and Pistols are preferred by the Naxalites because these can be easily concealed and carried while they are moving in public. That is why Country made 12 bore and 8mm pistols are more in number than the long barrel guns. Based on the observations strict measure to restrict the sale of ammunition in large quantities and ban of 12 bore guns & 8 mm rifles and ammunition are suggested to counter the Naxalism.

Key Words

Community Participation

Vehicle Borne Explosive Device

Special Events Location

Neighbourhood Watch Scheme

Eyes and Ears Scheme

Intelligent Video Cameras

Community Participation in Security against Terrorism

Brig. M.S. Khara*

Introduction

The deteriorating security situation in the country has put tremendous pressure on the Police Forces to meet the challenge of preventing terrorists striking at will. As seen in various blast incidents in the country and the world in general, militants have been able to place bombs, Improvised Explosive Devices (IEDs) and carry weapons to public places and strike at will.

In India, the Police force is insufficient to carry out normal policing. Our national average is just (126 officers per 10,00,000 people.) The United Nations norms is 222. The Intelligence Bureau, responsible for internal intelligence-gathering, has a sum total of 3,500 field operatives for a country of 1.1 billion. Not only the reduced strength, but the lack of proper training and equipment to handle latest techniques of terror also are further reducing the efficiency of these forces. These forces were raised to handle primarily normal law and order problems in the country, the worst of these being dacoity, riots and murders. The latest commitments to counter the threat of terrorism has strained the resources of Police Forces to an extent that it is difficult for them to carry out normal policing as well as anti-terror operations with the same degree of efficiency.

In order to overcome the shortage of Police forces in our country, there is a requirement of utilizing the hidden potential of masses to assist in Policing Duties to ensure that proper law and order is maintained even in intense terror threat environment. Every child, adult or old age person must be prepared to act as a policeman wherever he is and whatever he is doing, as terror attacks can take place anywhere and at any time

Recently, Delhi Police started an “Eyes and Ears” scheme wherein small traders, vendors, porters and auto rickshaw drivers have been roped in to provide inputs on possible terror attacks. The scheme has got a good response and given the right opportunity to be involved, the citizen can become the silent army of the state.

Modus Operandi of Terrorists

Terrorists are an opportunistic lot. They exploit vulnerabilities left exposed, choosing the time, place and method of attack according to the weaknesses they observe or perceive. Few terrorist attacks are executed without pre-operational surveillance of the desired target to determine target suitability, security and noticeable patterns in the Targets, physical security, and the surrounding environment. Increasing the security and look out for suspicious activities or “things out of place” makes it more difficult for terrorists to carry out effective surveillance. Terrorists get several years to plan their activities, whereas the security forces have to react in a matter of seconds.

Signs of Terrorist Activities

The Signs of Terrorists Carrying Out Surveillance
Key activities suggesting possible terrorist surveillance is in progress may include:

- Foot surveillance involving 2-3 individuals working together.
- Persons or vehicles being seen in the same location on multiple occasions; persons sitting in a parked car for an extended period of time.
- Persons not fitting into the surrounding environment, such as wearing improper attire for the location.

*Brigadier, Indian Army



- Persons using possible ruses to cover their activities, such as taking on a disguise as a beggar, demonstrator, shoe shiner, fruit or food vendor, street sweeper, or a newspaper or flower vendor not previously recognized in the area.
- Persons videotaping or photographing security cameras or guard locations.
- Unusual or prolonged interest in security measures or personnel, entry points and access controls, or perimeter barriers such as fences or walls.
- An increase in anonymous threats followed by individuals noticeably observing security reaction drills or procedures. Questioning of security or facility personnel by an individual(s) that appears benign.

Signs of Possible Terrorist Activity

Parking Areas and Public Areas where Vehicles are Parked in Unorganised Method : The following signs will be give away of terror activity about to take place in a Parking Area:

- ❖ A vehicle remains unclaimed by its owner or exceeds the parking time.
- ❖ A vehicle emits a strange odour, such as a chemical (e.g., vinegar-like) or organic smell (e.g., fertilizer.)
- ❖ A vehicle containing metal cylinders, tanks or containers, or any unusual wiring.
- ❖ The license plates on a vehicle do not match. (Also, notice the numbers etched on the windscreens; the registration type does not match the vehicle type: scooter series on a car)
- ❖ The registration or inspection stickers appear altered or falsified.

Railway Stations, Bus Stands and Metroes
The following signs will be give away of terror activity about to take place in Railway Stations, Bus Stands and Metroes:

- * Individuals with unusual packages (e.g., suitcases, boxes with wires protruding, cans, etc.)

- * Suspicious activity by an individual entering the place. The individual is alone, excessively nervous, perspiring, wearing bulky clothing that is inappropriate for the season's temperature/ weather conditions or the appearance of an individual wearing attire in what appears to be a means of disguising his true identity, etc.
- * Individuals observed loitering on the train platform, opting to let trains leave without boarding.

At Special Events Locations : The following signs will be give away of terror activity about to take place in an area where special events are likely to take place that entails very large gathering of people:

- ◆ The appearance of a suspicious vehicle or bicycle with a package in the basket parked near the area designated for the event to take place.
- ◆ Actions by an individual that suggest the pre-event videotaping of the route or location for no apparent reason.
- ◆ The sudden appearance of a new street vendor in an area adjacent to the event route or gathering location.
- ◆ Unclaimed or suspicious packages/objects found along the special event route/location.
- ◆ Recent attempts by unknown individuals to gain access to buildings roof overlooking the special event location.
- ◆ Suspicious inquiries by unknown individuals regarding the security measures anticipated for the event.

Signs of Suicide Bombers About to Act : Some of the visible markers associated with suicide bombers known to have attacked soft targets are:

- **Irregular dress :** Loose fitting clothes, large sweatshirt, vest, jacket in hot weather.
- **Repeated patting of the self** (checking the location of the switch, etc).
- **Irregular or inappropriate baggage** being carried such as a large briefcase into a club or restaurant.

Abstract

The fast deteriorating security environment in the country has put tremendous pressure on the Police Forces to maintain normal law and order and also to simultaneously face the growing threat of terrorism. To overcome this problem, there is a requirement of motivating the common man to carry out policing duties in their normal routine activities.

Community Participation in Security against Terrorism

- ❑ **Luggage or kit/gym bag** obviously weighed down more than normal.
- ❑ **Do not discount the prospect for male or female suicide bombers** or even male/female suicide team.
- ❑ **Common Questionnaire** for all Locations to Enable Heightened Awareness in All Citizens. A massive advertisement campaign needs to be launched to address various give aways of terror activities. Each citizen must be able to answer the following questions to himself at any point of time:
 - ❑ **Surveillance:** Are you aware of anyone video recording or monitoring activities, taking notes, using cameras, maps, binoculars, etc., near key facilities/events?
 - ❑ **Suspicious Questioning:** Are you aware of anyone attempting to gain information in person, by phone, mail, email, etc., regarding a key facility or people who work there?
 - ❑ **Tests of Security :** Are you aware of any attempts to penetrate or test physical security or procedures at a key facility/event?
 - ❑ **Acquiring Supplies :** Are you aware of anyone attempting to improperly acquire explosives, weapons, ammunition, dangerous chemicals, uniforms, badges, flight manuals, access cards or identification for a key facility/event?
 - ❑ **Suspicious Persons :** Are you aware of anyone who does not appear to belong in the workplace, neighbourhood, and business establishment or near a key facility/event?
 - ❑ **“Dry Runs”:** Have you observed any behavior that appears to be a preparation for a terrorist act, such as mapping out routes, playing out scenarios with other people, monitoring key facilities/events, timing traffic lights or traffic flow, or other suspicious activities?
 - ❑ **Deploying Assets :** Have you observed abandoned vehicles, stockpiling of suspicious materials, or persons being deployed near a key facility/event?

Duties of Various Sections of Society Towards Awareness

The overall aim of community participation in security is to spread the message that each citizen is a police man in civil clothes. We shall discuss in succeeding paragraphs how each citizen can be made to form part of the system to check terrorism.

Role of School Going Children

Schools can organize debates, poster competition and essay competition to encourage children participation and to make children think imaginatively. Security related subjects can be introduced as a part of Social Science Subject at the school level for classes VIII, IX and X by the Ministry of Human Resources Development.

Role of Cab/Auto Rickshaw Drivers

The Cab/Auto rickshaw drivers are the first ones to come in contact with a passenger entering a city. All Cab/auto rickshaw drivers must be repeatedly briefed for carrying out the following security tasks:

- ◆ Critical eye on the behaviour of passengers.
- ◆ Pick up the theme of any conversation amongst passengers.
- ◆ Look out for any unusual luggage. Try to ascertain the religion of the passengers and place where they are coming from.
- ◆ After dropping the passengers, keep an eye on them for as long as possible to see where they are heading after getting off from rickshaw.

Private Security Agencies

There has been a proliferation of private security agencies in recent times, providing manpower to guard diverse assets from corporate facilities and housing societies to high and middle income group residences. Such a large manpower employed for access control is essentially untrained and performs tasks of a typical neighbourhood night watchman. The police should launch programmes to provide them relevant “on the job training” and incorporate

This huge potential of our masses lying unexploited so far, once unleashed, shall create an environment where no militant dares to carry out any kind of terror activity without being caught. The paper gives out the modus operandi of terrorist groups and various tell-tale signs that shall enable common man to detect a terror activity about to take place.



Community Participation in Security against Terrorism

them suitably in the security setup, to further restrict the freedom of terrorists. The license for any security agency must be given for not more than one year duration. Each and every guard hired by the security agency must be verified by the Police and also tested for proficiency and security awareness. A new guard must not be allowed to function unless the requisite Police Certificates are available with the guard.

Shopkeepers

All shopkeepers must be able to keep the area around their shops sanitized and also keep an eye on any suspicious customers and be able to inform the Police authorities well in time. Terrorists are increasingly using commercially available chemicals to fabricate improvised explosive devices. Any person attempting to procure such items in a large quantity should be reported to the police or a person who looks nothing like a fanner or gardener buying ammonium nitrate fertilizer can be viewed with suspicion. Similarly, internet cafe owners are an important source of information. We can make them more aware, vigilant and responsible

Hotels and Guest Houses Owners

The owners of hotels and guest houses have a very important role to play in detecting terror related activity. They should have security cameras installed at the reception so that all guests are photographed and the photographs are saved for a minimum of seven days after they have left.

Cycles and Old Vehicle Dealers

The militants try to purchase or hire old vehicles to carry out their mission. All dealers of old vehicles must be made aware of this fact and made to feel responsible enough to report any suspicion about the purchasers at the earliest.

House Owners & Owners of Rented Commercial Properties

It is the responsibility of the owner of residential or commercial properties to ensure their tenants

have been verified by the Police. The owners should also be made responsible to keep an eye on the activities being conducted in the premise rented out by them, by frequently inspecting the complete property for any signs of suspicious activities

Street Vendors

The street vendors are the ones who are coming in contact with a very large cross section of floating population. This floating population is either moving for their work, doing shopping or waiting for some body or simply loitering around. A critical eye on floating population by these street vendors to look out for any suspicious looking person or any unattended baggage or any unnaturally parked cycle or vehicle in the near vicinity will contribute immensely towards the general security of the place.

Maid Servants

In 1985, a series of transistor bombs exploded in different parts of Delhi causing the death of at least 50 and creating panic in the capital. The case was cracked in a few days by information provided by a maid servant. She had seen the terrorists assemble a bunch of transistors and reported the matter to the police. This crucial role played by the anonymous maid servant in apprehending the perpetrators of the crime underlines the role a common citizen can play in combating terror.

Street Scavengers

The street scavengers, the *safaiwalas*, the municipal garbage disposal personnel are all required to be on lookout for any suspicious looking items lying on the street. They are the ones who will come in contact with these objects before Police or any other local resident do.

The daily wage earners and casual labourers must look out for suspicious looking persons loitering around the area.

It also lists out the duties of each strata of our society including school going children and also gives out the roles of local organizations to create a mass movement of security conscious people to keep the areas around them sanitized. Market committees and Mall owners have a very important role in preventing any terror related activities in crowded commercial spaces.

The optimization of Private Security Agencies and Use of Intelligent Security Cameras in Public Places will further reduce the load on Police Resources from normal law and order problems and concentrate on anti-terror operations. Methods of creating mass awareness that shall bring home the point to a large population has also been dealt with in this paper in detail.

Community Participation in Security against Terrorism

Local Resident Welfare Associations/ Housing Societies

The local resident welfare committees/Housing Societies are powerful bodies that can be used for implementation of security measures in the area. These associations should be registered under the Societies Act and their elections must be watched by the concerned officer of Ministry of Personnel. These associations should ensure that private security guards are employed by them, cable-TV provider, internet provider, newspaper vendor, local taxi stand, neighbourhood shop, home-delivery food outlets, electrician, plumber, parking attendant at shopping centre provide information of suspicious people in their colony.

The governing body of these associations should be entrusted with the following security duties:

- Ensuring no letting-out of houses /flats without proper police verification.
- Keeping a check on the residents and also monitoring visitors to the residents including their car numbers.
- All casual labourers working in the area must be able to give some cross reference of some known person for proving their identity.
- Ensure patrolling is being carried out as per the desired procedure, to ensure there is no gap in the area being patrolled and proper liaison is being maintained with the Police Authorities.
- Regular meetings will be held at Police Headquarters of all members of RWAs to apprise them of the latest security situation and methods to prevent any terror related incidents. These RWAs will further have meetings at their levels in the colonies to sensitize the residents of all the precautions that need to be taken to ensure no terror incident takes place in their area.

The areas which are more likely to be terrorist hideouts are irregular colonies, villages and slum areas of Delhi and NCR region. These localities are thickly populated. The population being poor, it is

more vulnerable to being lured by money or religious fanaticism. These localities have narrow lanes and each house has number of floors with number of rooms on each floor. There is hardly any ventilation in these rooms. One can stay in these places for days together without any person in the immediate neighborhood coming to know. These are the areas where greater efforts are required to keep them sanitized.

Market Committees

The market committees are another instrument of Public Security. The number of entrances should be limited so that the floating population can be screened before they enter the shopping complex. The cycle or vehicle borne explosive devices (VBED) are a major hazard in crowded places. Any stranger coming on a cycle or a vehicle filled with bomb will park close to a crowded area and move inside the market place to get out of danger area. Similarly, any person with a criminal intent can leave a bag in the crowded place and explode it once he is out of danger area. The market committees must institute proper measures to ensure the following:

- Check the identity of the driver and passengers inside the car. Institute a robust vehicle inspection program to include checking under the undercarriage of vehicles, under the hood, and in the trunk. Provide vehicle inspection training to security personnel.
- Have a predetermined parking area for all types of vehicles at a safe distance from the market place
- Increase perimeter lighting. Remove vegetation in and around perimeters.
- Deploy visible Security cameras and motion sensors.
- Increase the number of visible security personnel wherever possible.
- Coordinate and establish partnerships with local police authorities to develop intelligence and information sharing relationships.
- X-ray all packages, if possible, prior to entry, and inspect all handbags, and briefcases.



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- ❑ Install special locking devices on manhole covers in and around facilities.

Each market committee must present its security plan to the local Police Commissioner, without taking into account the Police Protection, which should be over and above the Market Security System as it may not be possible for the Police Force to provide the number of security persons required to meet the optimum requirement.

Mall Owners

The nature of malls makes them very vulnerable. There are multiple entrances and exits, and these are open to the public. Many of the visitors carry large parcels that could hide a bomb or other weapon. There are multiple ways to attack a mall, ranging from automatic weapons to car bombs to bombs placed inside the mall, even to an attack using a biological or chemical agent. Moreover, the consequences of an attack could be quite serious.

The mall security should be planned in number of concentric circles. In the outermost circle are roving patrols of one or two security officers and vehicle inspection points. Bollards and retractable barriers are used to keep vehicles from being driven through the checkpoints. Once inside the outermost perimeter, all pedestrians attempting to enter the mall have their bags searched and must be scanned by a metal detector/x-ray scanner. Inside the mall (the innermost circle), one or two armed security officers should patrol and observe visitors.

There is also a need for regulating private security systems in retail malls. The regulation process consists of stringent licensing procedures carried out at the local level and overseen by local police commanders. The regulations should give out minimum numbers of security guards, vehicle checkpoints, and barricades. The district police should also license and approve all armed security candidates and license all unarmed security officers. There should also be frequent on-site inspections. Typically, the district police should inspect each mall once or twice a month. In addition, they should observe many of the drills being conducted by the mall security staff. Each mall

should be required to re-apply for licensing every year. There is also a requirement of joint exercises attended by the district fire brigade, ambulance system, and the entire police district. In addition, there should be open intelligence sharing between mall security and local police stations. Finally, mall security and local police station must share interoperable communication systems. In the event of an emergency, each unit could communicate with one another over a shared radio-communications band.

Mall owners should be encouraged to install caller ID devices in their telephones. Take any threatening or malicious telephone call, facsimile, or bomb threat seriously. If such a call is received, obtain and record as much information as possible to assist in identification of the caller including recording the time of the call, the exact words, any distinguishing features of the caller, and any background noise.

Mass Awareness through Mass Media

There are a large number of ways to educate masses. These are:

- **Television** : Some serials could be sponsored by the Home Ministry and telecast on TV Channel with the theme of Community Participation for security.
- **TV Advertisements** : TV advertisements on the role of common people and RWAs and their role in Security.
- **Security related Chapters in School Text Book** : The modus operandi of militants and the role that can be played by students towards security awareness must be included as a separate chapter in school text books. Even colleges should institute lectures in community participation for security in all their courses.
- **Radio and FM** : Radios and FMs are very important instruments of public education. These channels of communication must be exploited to spread public awareness and to make every citizen feel responsible towards security.

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Posters and Banners

A large number of attractive posters and banners could also be put up to spread security awareness. These advertisements could be designed by the best advertisement agencies in the area.

Extensive use of Security Cameras

The only convincing way of dealing with terrorist is to increase a terrorist's risk of getting caught on camera in at least one of the locations. Installing Closed Circuit Television (CCTV) cameras in susceptible places like markets, shrines, hospitals and colleges would help information on terrorists, should they decide to attack. These cameras may be visible or hidden. Britain had started using CCTV cameras to combat IRA terrorism during the 1970's and today has the highest amount of camera surveillance in the world. In London, there is a good chance that one will be captured by over 300 cameras in a single day.

A good quality four-camera system that will pan and take images from all directions for up to 60 feet costs just Rs 11,500. Five thousands such cameras in New Delhi would cost Rs 57.5 crores. These CCTV cameras must have recording facility to enable retrieval of data up to minimum of 96 hours so that anyone planting a time bomb can be traced out later.

The CCTVs are static systems which require constant human monitoring. Today, the trend is to have intelligent video camera systems which alert the appropriate personnel in real-time, using the internet, and even having mobile phone alerts, etc. The London Underground train terrorists were quickly caught through National Networking of such systems.

Policing of Police

Last, and the most important, we must respect and honour the beat constable, and do not bog them down with work that has nothing to do with the police force. The beat constable is the person who will first spot the stranger in the neighbourhood, the unclaimed

bag and the suspect late night buzz on the third floor- and possibly save lives.

Demands on Intelligence and Police Forces

In such a situation where we expect large scale public service towards security, the intelligence community shall have to contend with deliberate hoaxes by terrorists, to mislead them and distract attention from the actual target. A very fine balance shall have to be maintained to filter out such warnings as it may not always be pragmatic to raise an alert for protracted high levels of readiness by law enforcement agencies at periodic intervals. We should be prepared to accept that a majority of such leads may not result into anything significant, but their value does not diminish. The effort made by a security conscious citizen in observing something that is out of place and informing the police needs to be recognised and always encouraged.

Conclusion

As seen above, community participation in security against terror attacks has become of paramount importance. If every civilian acts like a cop in civil dress, no terror related incident can ever take place, no matter how determined the terrorist is. It, therefore, must be encouraged by the Government. It will not be out of place if a new department be raised in Home Ministries of each state to ensure public participation in security is exploited to the maximum. In the present scenerio, this appears to be a silver lining in the intensely gloomy security situation of the country.

Community policing must, therefore, become part and parcel of the basic philosophy of policing and needs to be institutionalized in our country with adequate legal and organizational support.

References

- J Norman Reid (June 2000) "How People Power Brings Sustainable Benefits to Communities"
- David Wilcox (Aug 1994) "Community Participation and Empowerment: Putting Theory into Practice"



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A VS Reddy (1996) 'Disaster Mitigation through People's Participation: Role of Local Self-Government Institutions' *Asia Pacific Journal of Rural Development*, Vol. No 2.

Jacob Dharamraj (1996) "Mobilizing community participation in Disaster Management"

Charles P Connolly (June 2003) "Role of private security in combating terrorism".

K.N. Gupta (Sept 2001) "Indian Police & Vigilance- In the 21st century".

Sinlung (Aug 2008), "Extract of meeting of Chief Secretaries of DGPs of various states in Delhi".

Key Words

Terrorism,
Rational Choice
Model,
Game Theory,
Prisoner's
Dilemma,
Public Goods

Microeconomic Analysis of Terrorism

Rajnish Kumar Rai*

Introduction

Terrorism is defined as “the premeditated use, or threat of use, of extra-normal violence or brutality to gain a political objective through intimidation or fear.” (Sandler and Hartley, 1995: 308) Thus, terrorists have political ambition in the sense that they strive to “change the system,” something that is not a priority for ordinary criminals (Hoffman, 1998: 42). Terrorists operate outside the usual rules of warfare pertaining to civilians, diplomats, prisoners, etc. They use extra normal violence or brutality such as indiscriminate attacks against civilians, security forces and important installations, taking hostage of diplomats and important political leaders, etc. to capture news headlines (Hoffman, 1998: 34-35). When the public becomes indifferent to their acts of violence, terrorists respond with more ghastly acts to recapture public and media attention (Sandler and Enders, 2004: 301). They deliberately attempt to create a general atmosphere of fear by striking at a variety of targets with alternative modes of operations, thus making it difficult for the law enforcing authorities to anticipate the target of the next incident (Sandler and Enders, 2004: 301). This is intentionally done to make the attacks appear to be random, so that the targeted society expends large amounts of resources to protect a wide range of vulnerabilities (Sandler and Enders, 2004: 301). This simulated randomness provides terrorists with a cost advantage over the stronger authorities that

must defend against the threat that they pose (Hirshleifer, 1991). Terrorists succeed in achieving society-wide anxiety with a minimal amount of resources because people tend to overrespond to unlikely catastrophic events while ignoring more likely daily dangers (Sandler and Enders, 2004: 301). Finally, the terrorist activities are rich in externalities because they are designed to have psychological effects that extend beyond the immediate victims.

Concepts and principles of microeconomics can be utilised to provide insights in studying terrorism. Strategic interactions among opposing interests-e.g., the terrorists and the authorities, or between two targeted countries can be analysed using the principles of microeconomics. Besides, rational-choice models, based on microeconomic principles, can also be applied to ascertain how terrorists are apt to respond to policy-induced changes to their constraints. The same methods can also be used to analyze how governments react to terrorist-induced changes to their policy-making environment. In addition, various economic empirical methods can be applied to evaluate theoretical predictions and policy recommendations.

Historical Data

To provide a perspective of the nature of the international terrorist threat and domestic terrorist strikes, data is compiled in Figure 1. According to

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This paper is upgraded version of a term paper submitted in partial fulfilment of the course on Micro & Institutional Economics during Post Graduate in Public Policy and Management, Indian Institute of Management, Bangalore. The author is extremely grateful to **Prof. Gopal Naik** for his relentless encouragement and comments on the earlier version of the paper.



RAND-MIPT, “international terrorism includes incidents in which the perpetrators go abroad to strike their targets, select domestic targets associated with a foreign state, or create an international incident by attacking airline passengers or equipment.” Examples of international terrorism are Laskhar- e- Toiba’s attack at the Indian Parliament, Jaish-e-Mohmad’s attack at Akshardham at Gandhinagar, Gujarat, Aftab Ansari’s attack at American Centre at Kolkata, Al Qaeda’s attacks against U.S. embassies in Kenya and Tanzania in 1998 and the World Trade Center and Pentagon in September, 2001. Domestic terrorism is defined by RAND-MIPT as “incidents perpetrated by local nationals against a purely domestic target.” Reliable data from 1968 to 2003 for international terrorism could be obtained from RAND-MIPT but reliable data for domestic terrorism could be obtained only for the period from 1997 to 2001.

Figure 1 shows the time paths for international terrorist incidents and for domestic terrorist incidents (divided by 10). Following observations can be drawn from it:

Figure 1: World Wide Terrorist Incidents



- * Though it is perceived that terrorist activities are on rise, it is found that there is no upward trend in the international incidents during the sample period.
- * It is generally believed that after the attack of September 11 in the United States, the number of international incidents increased but Figure 1 shows that the terrorist incident remained below the mean in five of the last six years.
- * Incidents of domestic terrorism around the

world are much more numerous than international incidents, at least for the limited period of 1997-2001.

Due to limited availability of authentic data on domestic terrorism, the remaining paper focuses on international terrorism.

Figure 2 depicts casualties (deaths plus injured) and casualties per incident caused by international terrorism worldwide. Upward trends are evident in both the series, suggesting that international terrorism is increasing in severity.

Figure 2 : Worldwide Casualties (Deaths+Injured) from international terrorist incidents

Particularly noticeable is the higher casualty rates post 1990s’ (since the end of the Cold War). Scholars attribute the increase in severity of the terrorist attack to the growth in religiously motivated acts of terrorism (Enders and Sandler, 2000: 329-330; Hoffman, 1998: ch. 4; Juergensmeyer, 2000; for criticisms of “religion and violence” perspectives on terrorism, Cavanaugh, 2004).

Figure 3 depicts the frequency of international terrorist strikes against political and civilian targets. Since all terrorist incidents by definition are fundamentally political, terrorist attacks against governments, diplomats, or military are classified as political and terrorist attacks involving strikes against airlines and airports, businesses, journalists, non-governmental organizations, private citizens and property, religious organizations, transportation assets, etc are classified as civilian. Figure 3 show that international terrorists in the aggregate chose civilian and political targets with

Abstract

Sociologists and economists have mostly discussed the links between terrorism and economics in terms of how poverty, inequality, and limits on opportunity, because of skewed government policies shape terrorist responses, and on how the alleviation of these conditions might reduce the acts of terrorism.

Figure 3: International incidents by targets

roughly equal frequency prior to 1990 but thereafter, a greater frequency of civilian relative to political targets has emerged.

Rational Choice Model

The rational choice model can be applied to terrorism by assuming that individuals and organizations have preferences over terrorist as well as ordinary activities. Let us carry out the analysis in terms of two commodities, terrorism T and composite good C, where the latter is defined as real expenditures on all goods other than T.² Standard indifference curves can be used to show terrorists' preferences over T and C, with T on the horizontal axis. A relatively high degree of curvature of the indifference curves would imply a relatively low degree of substitutability between T and C. If terrorists are willing to sacrifice some C to achieve an increment to T, their indifference curves would be steep in T-C space. But for non-terrorists, the indifference curves would be flat or upward sloping, as terrorist activity has no utility or even disutility for them.

This concept can also be utilised for other applications like terrorist preferences over alternative targets, for example, political and civilian targets. The lesser the curvature of the indifference curves; the more willing terrorists are to substitute among targets. Regarding Al Qaeda's targeting philosophy, Osama bin Laden has been quoted, "We do not differentiate between those dressed in military uniforms and civilians. They're all targets."³ The indifference curves of those terrorists who are

strictly motivated to strike one class of target but not other will be either horizontal or vertical.

Let us assume that terrorists have income I, which can be allocated over T and C according to the budget constraint $I = P_T T + P_C C$, where P_T is the price (cost) of carrying out terrorist activities and P_C is the price of the composite good. Let us further assume that resources RT are allocated to terrorist activities. The budget constraint then becomes $RT = P_1 T_1 + P_2 T_2$, where T_1 and T_2 are targets (e.g., political and civilian) and P_1 and P_2 are the prices of carrying out the respective missions.⁴ Then according to the principle of utility, utility maximization to choice of T and C will occur where the absolute value of the marginal rate of substitution (MRS) of T for C is equal to the relative price of terrorism P_T/P_C . At this point the budget line and the indifference curve of the terrorist organisation are tangent, and no higher level of satisfaction can be attained. Various aspects of terrorism behaviour can be studied and explored by altering the key parameters of the rational choice model (i.e., income, prices, preferences).⁵

Applications of Rational Choice Model

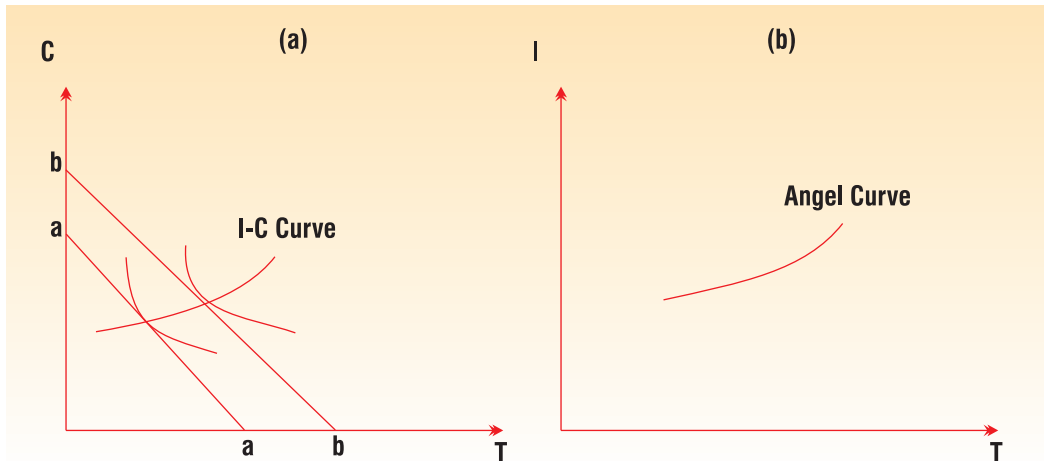
Income-Consumption and Engel Curves: Terrorist Access to Resources

Terrorists are rational beings who maximize expected utility or net payoffs subject to constraints. As discussed above, the theoretical model for the terrorists that underlies their study is analogous to the consumer-choice model. Terrorists maximize utility or expected utility derived from the consumption of basic commodities, produced from terrorist and non-terrorist activities. Since terrorist groups are dependent upon financial resources for their survival as well as for carrying out terrorist activities, they constantly endeavour to maintain or increase their income. In Figure 4(a), suppose that the terrorist group has carried out a spectacular hijacking (e.g., 9/11) or Attack at the Parliament (e.g., 2001), which generates publicity and new financial support for the terrorist group among its sympathizers. This results into outward shift in

The direct role of economic factors, such as poverty and inequality, and of policy measures, such as sanctions, is one way to examine the economics of terrorism. But these measures are incomplete. It is also important to look at how terrorism affects behaviour, how economic concepts can help us understand the behaviour of individuals and organizations that employ the tools of violent terrorism,



Figure 4: Income-Consumption (I-C) Curve and Engel Curve for Terrorism



the group's budget constraint from aa to bb, which allows the group to acquire additional resources for more terrorism and other goods. The income-consumption curve in Figure 4(a) connotes an Engel curve for terrorism in Figure 4(b). This can be used to find out the income elasticity of terrorism. If the composite good, consisting largely of consumer goods like food, clothing, and housing, were viewed by terrorists as a necessity, then C would be income-inelastic. Since sum of weighted income elasticities is one, meaning thereby that terrorism is income elastic, as depicted in the relatively flat slope of the Engel curve in Figure 4(b).

While terrorists continuously try to increase their resources, governments, as part of counter-terrorism policy, endeavours to reduce resources available to them by freezing / seizing their financial assets and upsetting flows of funds to them. For example, the Prevention of Terrorism Act, 2002⁶, USA Patriot Act of 2001, etc. have given extra powers to the law enforcement agencies to contain money laundering through new regulations, sanctions, and seizure / forfeiture rules. Let us now assume that counter-terrorism income policies reduce the budget constraint of the terrorist group from bb to aa (Figure 4(a)). If terrorism is income elastic, counter-terrorism income policies could be particularly effective in containing terrorist activities. As terrorist activities generate publicity and increases future

terrorist fund-raising, similarly counter-terrorism income policies today could reduce future terrorism.

Price-Consumption Curve: Terrorist to Price Changes

Besides the income policies, governments endeavour to frustrate terrorism through price policies like increasing the defence of potential targets, attacks against terrorist training centres, capture of selected terrorist leaders, and infiltration of terrorist groups. This increases the price of terrorism PT. The policy of raising the opportunity cost of terrorism by making terrorist activities more expensive is termed as deterrence policy. In contrast to deterrence policy, some scholars have also investigated the potential for "benevolence policy" to reduce terrorism (Frey and Luechinger, 2003). In this case the government raises the opportunity cost⁷ of terrorist activities, not by increasing the price of terrorism, but by reducing the price of the composite good.

The comparison and contrasts between deterrence and benevolence price policies to reduce terrorism are depicted in Figure 5. Let us assume that the initial budget constraint available to the terrorists is aa. According to Figure 5, terrorists consume T1 in terrorist activity and C1 of other goods. A deterrence policy increases the price of terrorism PT by raising the expected costs of terrorist activity, causing the budget line aa to rotate in along the T

and how economic concepts can help formulate tools to combat terrorism. The utility maximization model provides insights into both terrorist resource allocation choices and government counterterrorism efforts, while basic game theory helps characterize the strategic interdependencies among terrorists and governments.

Microeconomic Analysis of Terrorism

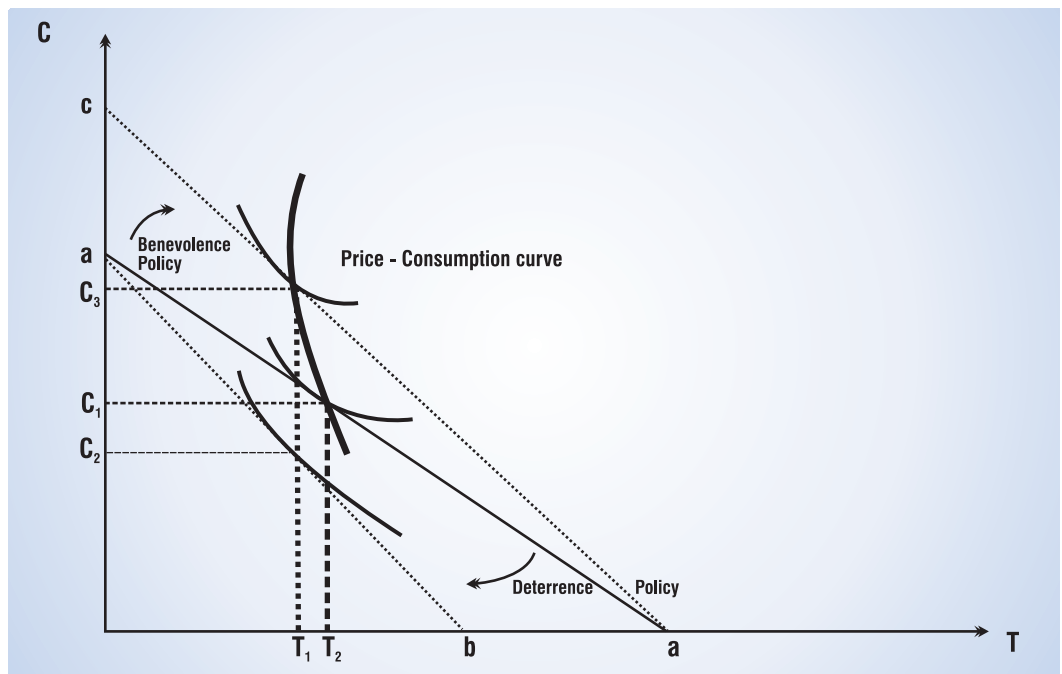
axis to budget line ab . The increased opportunity cost of terrorism is reflected in the steeper slope of the budget line. Therefore, in accordance with the law of demand, terrorist activity will be reduced to some lower level T_2 . Similarly, benevolence policy also raises the opportunity cost of terrorism, but it does so by increasing terrorist access to other goods by lowering PC that causes budget line aa to rotate outward along the 'Y' axis to point c . This is depicted in Figure 5 by budget line ca . Again, the steeper budget line implies a higher opportunity cost of terrorism. Thus, due to the price-reducing benevolence policy, terrorists choose a reduced level of terrorism, which for convenience is drawn equal to T_2 , the same level as under deterrence.

As discussed above, the decrease in PC reduces terrorism from T_1 to T_2 , but it is also logically possible that a decrease in PC may have the opposite effect and instead it results into increase in terrorism. This can happen when the optimum on the final indifference curve vis-à-vis the new budget line CA falls to the right of terrorist level T_1 . The two possibilities are distinguished by the slopes of their respective price-consumption curves, which are

linked to different values of the own price elasticity of the composite good ECC. In Figure 5, a decrease in PC generates a new optimum along a negatively sloped price-consumption curve and therefore, a decreased level of terrorism. This occurs if and only if the composite good is price elastic. In the alternative case, a decrease in PC results into a new optimum along a positively sloped price-consumption curve and therefore, an increased level of terrorism. This occurs, if and only if the composite good is price inelastic.⁷

There are a number of ways to institute anti-terrorist policies that address these likely substitutions and complementarities due to change in PC or PT. First, the government must make the terrorists substitute into less harmful events. Second, the government must go after the terrorists' resource endowment (i.e., its finances, its leadership, its membership) if an overall decrease in terrorism is to follow. Efforts to infiltrate groups or to freeze terrorist finances have this consequence. Third, the government must simultaneously target a wide range of terrorist attack modes, so that the overall rise in the prices of terrorist attacks becomes analogous to a decrease in

Figure 5: Deterrence and Benevolence Price Policies to Reduce Terrorism





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resources. Success in raising the price of all modes of terrorist attacks would induce terrorists to shift into legal protests and other non-terrorist actions to air grievances. A reliance on technological barriers merely causes a substitution into other attack modes in the short run. In the long term, terrorists will develop ingenious counter-measures (i.e., plastic guns, bottles of flammable liquid, improvised explosive devices, etc.) to circumvent the technology. Thus, there is a dynamic strategic interaction present, where authorities must be vigilant to improve the technology by anticipating ways of circumventing such barriers. Unfortunately, authorities have been reactive in practice by only responding after a technological barrier's weakness has been exploited, leaving the public vulnerable until a new technological fix is found and installed.

Preference Policies

Although economists often take preferences as given and then focus on the effects of income and price changes on key variables counterterrorist efforts to modify terrorist preferences are worth considering.⁸ The objective of counter terrorist preference policies is to make terrorist preference maps horizontal in T-C space, such that terrorists receive no utility from terrorist activities. According to the rational choice model, advertising is an important variable that might change preferences. But, since terrorist preferences are formed within a complex web of cultural, historical, political, and social variables, it may be overly simplistic and optimistic to believe that counterterrorist "advertising campaigns" by governments could level down terrorist preferences. Nevertheless, marginal positive effects of advertising cannot be ruled out. Let us consider the example of the overt propaganda of Pakistan regarding the forcible occupation of Jammu & Kashmir valley by Indian security forces and blatant human right violations by them. It is likely that the degrading images of human right violations by the Indian security forces may harden the preferences of terrorists against the Indian establishment. Besides, it may also create terrorist preferences among some individuals who previously had flat indifference curves in T-C space. Hence, the negative propaganda regarding human right violation can be

viewed as a form of "negative advertising" that may reshape terrorist preferences toward more terrorism. Therefore, the counter terrorist policies should reduce the risk of events such as the deliberate or an accidental attack on religious sites. For example, storming of Golden Temple by the Indian Army (Blue Star operation – 1984).

In addition to "negative advertising" campaigns, Government can also resort to "Positive advertising" campaigns. For example, governments are aware of regions where terrorists reside or where the potential for terrorist recruitment is comparatively high. Some of these regions face a relatively high risk of natural disasters (earthquakes, super cyclones, etc.). In these regions if the Government resort to extra-normal publicity of natural disaster relief, it may affect the terrorist preference formation.

It is not that the Government only resort to the advertising campaign; terrorists also carry out advertising campaigns to portray the evils of the enemy and attempt to convince people about the rightness of their cause and to lure the youth to join them. Hence, governments and terrorist organizations both are engaged in an "advertising war" to influence the hearts and minds of the people. In this advertising game, both the governments and the terrorists try to gain "market share" by influencing what people know, or think they know, about themselves, governments, and terrorists. The advertising game is just one of many facets of game theoretic interaction between terrorists and governments.

Game Theory Perspectives of Terrorism

The game theory can be a useful supplement to the rational choice model in the analysis of terrorism because there is critical interdependence between terrorists and governments, and between governments themselves as they try to contain terrorism.

The stated policy of some governments, for e.g., US, Israel, etc., for the never-to-capitulate policy hinges on at least four implicit assumptions (Lapan and Sandler, 1988):

Microeconomic Analysis of Terrorism

- The government's deterrence is sufficient to stop all attacks;
- The government's pledge is fully credible to all would-be hostage takers;
- The terrorists' gains from hostage taking only derive from the fulfilment of their demands; and
- There is no uncertainty concerning the payoffs.

But these assumptions may not hold in practice. Deterrence will not stop all attacks, if the terrorists, perceive that there is a positive expected payoff from taking hostages. In addition, past concessions limit the credibility of the government's no-concession pledge. Moreover, a hardcore fanatical terrorist group may look for positive benefits from failure in terms of heavenly rewards or media exposure. Thus, the pitfalls to this policy are easily exposed by game theory.

Game Theory and Hostage Taking (Lapan and Sandler, 1998)

An extensive form of game shows the time pattern of choices between a terrorist organization

considering a hostage mission and a government deciding whether to negotiate for the hostages' release can be illustrated as below:

Figure 6 depicts the game tree for the hostage event. Let us assume that the government chooses deterrence expenditure, D , to fail and frustrate the terrorist hostage mission. The deterrence expenditure, D , may be treated as a sunk cost. The game tree begins with the terrorists deciding whether or not to pursue the mission. If the terrorists do not pursue the hostage mission, the status quo remains and payoff to both the players is 0. However, in the eventuality of terrorists attacking but failing to capture the hostages, they endure payoff $-L < 0$. The government also bears a loss from a failed terrorist attack in terms of loss of life of security forces, expenditure of resources, which is equal to $-A < 0$ in Figure 6. However, in the eventuality the terrorists attack and succeed in capturing the hostages, the government must decide whether to negotiate with the terrorists. This results in following two possibilities:

Figure 6: Government Terrorist Hostage Game



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- If the government negotiates, the terrorist organization obtains a payoff of $M > 0$ and the government suffers a loss of $-B < -A$.
- If the government does not negotiate, the terrorist organization receives payoff $N < M$, where N may be positive or negative. When the government does not negotiate, it suffers a loss $-C < -B$. The probability of terrorist logistical failure is and the probability that the government negotiates given terrorist logistical success is p .

The hostage game in Figure 6 (Lapan and Sandler, 1988: 17) is similar to an entry deterrence game, whereby a monopolist faces a threat of entry of another firm into its market. The monopolist can try to deter entry of the other firm by threatening to increase output and lower price if the rival enters. However, if the firm enters, it is not in the interest of monopolist to lower its price. The potential entrant can, therefore, dismiss the price-reducing threat of the incumbent as incredible. The equilibrium outcome in the entry deterrence game is for the potential entrant to enter and for the monopolist to not lower price (Varian, 2003: 509-10).

In Figure 6, the role of the government is that of a monopolist whereas the role of the terrorists is that of potential entrant. The government can deter a terrorist organization from pursuing a hostage mission by announcing the policy of not to negotiate with terrorists (setting $p=0$). If the terrorists believe the non-negotiation commitment of the government and since $N < M$, it reduces the terrorists' payoff and therefore potentially deters their entry into the hostage mission. Just like the monopolist's threat to lower price in the entry deterrence game, the government's threat to not negotiate with terrorists calls for it to carry out an action that, after the fact, is not in its interest ($-C < -B$).¹⁰

In the entry deterrence game, the monopolist has to make its threat about lowering of price credible to the rival if it enters. But once the rival has entered, it is not in the interest of the monopolist to carry out the threat. However, the monopolist can increase the credibility of its threat by investing in excess in capacity (Varian, 2003: 510). Many governments,

(eg. US, Israel, etc.) have announced a policy of no negotiation with the terrorists which pre-commit them to not negotiate with terrorists and if the terrorists believe in this pre-commitment policy, their expected payoff from a hostage mission are reduced.⁹

Counter terrorism Games Between Governments

Let us now consider the strategic interdependence between governments themselves as they try to contain terrorism. Government efforts to contain terrorism can be broadly classified as offensive or defensive.

Offensive counter terrorism includes attacks against terrorist training centres, bases, resources, and leaders; terrorist group infiltration; and attenuation of a terrorist group's ability to recruit members.

Defensive counter terrorism involves placement of screening devices and barriers in airports and buildings; risk-reducing modus operandi for diplomats, business people, military personnel, and tourists; and security alerts for private citizens and civil authorities.

The counter terrorism approaches cannot always be clearly classified as offensive or defensive; the distinction is useful because of various incentive issues faced by nations as they attempt to counter terrorism. For example, consider offensive efforts to debase Lashkar-e-Toiba. The security benefits of a weakened Lashkar-e-Toiba network are non rival (can be enjoyed by other nations at zero added cost) and non excludable (can be enjoyed by other nations regardless whether they contribute to the efforts). Hence, dilapidation of Lashkar-e-Toiba is a public good for threatened nations. According to public goods theory¹⁰, these nations have an incentive to free ride on one another's efforts, which can lead to underpinning of offensive counter terrorism worldwide.

Let us assume in an endeavour to debase an international terrorist organization, two nations A and B choose between two levels of offensive effort High and Low. To introduce explicit payoffs, suppose that strategy pair (Low A, Low B) returns 0 to each

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nation. Also assume that when one of the nations increases its effort to High, a resource cost of 6 is incurred by that nation alone, while an added security benefit of 5 is enjoyed by both nations.

This can be explained by the prisoners' dilemma¹¹ payoff matrix shown in Figure 7. Now to understand the payoffs, suppose B chooses High. If A also chooses High, then A enjoys a security benefit of $5 + 5 = 10$ but incurs a resource cost of 6, for a payoff of 4; on the other hand, if A free rides and chooses Low, then A receives a benefit of 5 but incurs no cost, for a higher payoff of 5. Now let us suppose instead that B chooses Low. If A chooses High, then A receives a benefit of 5 but a cost of 6, for a payoff of -1; if A chooses Low, then A gets 0 benefit and incurs 0 cost, for a higher payoff of 0. Hence, A's dominant strategy is to exercise a Low effort. The game is symmetric and results in the unique but Pareto inefficient Nash equilibrium (Low A, Low B).

The prisoners' dilemma provides an instinctive explanation for the low levels of offensive counter terrorism effort by nations prior to 9/11 (Cauley and Sandler, 1988).

Figure 7: Offensive Counter-Terrorism Game between Governments

Prisoners' Dilemma

	High Offence	Low Offence
High Offence	4.4	-1.5
Low Offence	5,-1	0.0

Conclusion

From the above discussions, we can see that virtually all features of the utility maximization model (e.g., Engel and price-consumption curves, substitution possibilities, etc.) can be used to explore terrorists' resource allocation and targeting behaviour and governments' counter terrorism efforts. Game theory models are also helpful in understanding the strategic interdependence between a terrorist organization and a government and between governments themselves as they

attempt to contain terrorism. Moreover, we can better understand terrorism given the insights provided by microeconomic theory. The microeconomics principles also raise a number of broader methodological issues that one finds very interesting. For example, questions like whether terrorists are "rational" usually lead to animated discussion, which can eventually be directed to various ways that economists and non-economists characterize rational behaviour. In fact, contrary to popular belief and media depiction, most terrorist attacks are neither crazed nor capricious. Rather, they are generally both premeditated and carefully planned. Thus, even though we might question the rationality of terrorist objectives, their methods of reaching objectives are rational in the common use of the term (i.e., premeditated and carefully planned).

End Notes

- 1 Data from US Department of State (1988-2003) and RAND/Memorial Institute for the Prevention of Terrorism (RAND-MIPT), www.indiastat
- 2 On the composite good convention, see Nicholson (2005, 167-170).
- 3 The statement was attributed to bin Laden by President Clinton in a speech delivered on August 20, 1998 (<http://usembassy-australia.state.gov/hyper/WF980828/epf502.htm>).
- 4 In a more advanced utility maximization model, RT would be endogenous. For example, a utility function over C and T could be posited with T in turn being a function of target choices (inputs) T1 and T2. The terrorist organization would allocate resources, I, over C, T1, and T2 to maximize utility.
- 5 Prevention of Terrorism Act, 2002 has now been repealed by the United Progress Alliance Government in 2004.
- 6 Cost associated with opportunities that are forgone when an outfit's resources are not put to highest value use.
- 7 The results described above follow from the budget constraint and the expenditures test for elasticity. In the case in Figure 5, when PC is



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decreased, terrorists spend less on terrorism, since PT is unchanged and T has decreased as dictated by a negatively-sloped price-consumption curve. With fixed income, nominal expenditures on the composite good must therefore increase when PC decreases. Because price and nominal expenditures move in opposite directions, C is price elastic. Hence, a negatively-sloped price-consumption curve and decreased terrorism implies elastic demand. Reversing the argument, elastic demand implies a negatively-sloped price-consumption curve and decreased terrorism. Similar logic applies to the alternative case with a positively-sloped price consumption curve, increased terrorism, and inelastic demand. For further discussion, see Anderton and Carter (2004).

- 8 Scholars from a variety of disciplines have delved into why terrorists exist and how they are motivated (i.e., how terrorist preferences are formed). See, for example, Hoffman (1998) (Political Science), Hudson (1999) (Sociology and Psychology), Lewis (2003) (History), and Stout (2002) (Psychology).
- 9 Another well-known game is battle-of-the-sexes, whereby each player is better off when they pick the same action relative to the case where they choose different actions. The game has two pure-strategy Nash equilibriums, but the preferences of the players over the equilibriums are in conflict. Battle-of-the-sexes could be applied when, for example, one nation prefers a pre-emptive war strategy while another nation prefers sanctions and diplomacy.
- 10 Public goods: Nonexclusive, non-rival good that can be made available cheaply but which once available, is difficult to prevent other from consuming.
- 11 Prisoner's dilemma: Game theory example in which two prisoners must decide separately whether to confess to a crime; if a prisoner confesses, he will receive a lighter sentence and his accomplice will receive a heavier one, but if neither confesses, sentences will be lighter than if both confess.

References

- Anderton, C. H. and J. R. Carter. 2004. "On Rational Theory and the Study of Terrorism" Mimeo.
- Cauley, J. and T. Sandler. 1988. 'Fighting world war III: A suggested strategy'. *Terrorism: An International Journal* 11 (Fall): 181-195.
- Cavanaugh, W.T. 2004. 'Sins of omission: What "religion and violence" arguments ignore". *The Hedgehog Review* 6 (Spring): 34-50.
- Enders, W. and T. Sandler. 2000. 'Is transnational terrorism becoming more threatening? A times series investigation. *Journal of Conflict Resolution* 44 (June): 307-332.
- Frey, B.S. and S. Luechinger. 2003. 'How to fight terrorism: Alternatives to deterrence' *Defence and Peace Economics* 14 (August): 237-249.
- Hirshleifer, J., 1991. 'The paradox of power'. *Economics and Politics* 3, 177-200.
- Hoffman, B. 1998. 'Inside Terrorism'. New York: Columbia University Press.
- Hudson, R.A. 1999. 'The sociology and psychology of terrorism: Who becomes a terrorist and why?' Washington, DC: Library of Congress, Federal Research Division.
- Juergensmeyer, M. 2000. 'Terror in the mind of God: The global rise of religious violence'. Berkeley, CA: University of California Press.
- Lapan, H. and T. Sandler. 1988. 'To bargain or not to bargain?: That is the question'. *American Economic Review* 78 (May): 16-21.
- Lewis, B. 2003. 'The crisis of Islam: Holy war and unholy terror'. New York: Modern Library.
- Nicholson, W. 2005. 'Microeconomic theory'. 9th ed. Mason, OH: Southwestern.
- Sandler, T. 2003. 'Collective action and transnational terrorism'. *The World Economy* 26 (June): 779-802.
- Sandler, T. and K. Hartley. 1995. 'The Economics of Defense'. New York: Cambridge University Press.
- Sandler, T. and W. Enders. 2004. 'An economic perspective on transnational terrorism'. *European Journal of Political Economy* 20 (June): 301-316.
- Stout, C. ed. 2002. 'The psychology of terrorism', 4 volumes. Westport, CT: Greenwood Press.
- Varian, H. 2003. 'Intermediate microeconomics: A modern approach'. 6th ed. New York: W.W. Norton & Co.

Key Words

Forensics, Crime Scene, Video Recording of Scene, Virtual Reality, Computer Graphics; Scientific Interrogation, Forensic Psychology, Narco-Analysis, Brain Printing, Scientific Surveillance, Sound Surveillance, Optical Surveillance, Microscopy, Spectroscopy.

Advancing Fronts in Forensics

B.R. Sharma*

Forensics and Justice

We all know that the word Forensic literally means 'pertaining to court of law'. In recent times, however, the word forensic (also Forensics or Forensic Science) has come to connote application of science to matters submitted or likely to be submitted to the courts for adjudication. Forensics, therefore, involves systematic scientific inquiry, experimental work, processing of data or facts or action to dig out data, information or objects to establish truth in a court case. It finds information or evidence to provide answers to the "why, when, what, where, who, whom, how" of an event or occurrence which has come up or is likely to come up for adjudication before the court. Thus, Forensics is applied science in its many splendoured facets which, using scientific tools and techniques, assists the courts in disseminating real justice.

The courts, for adjudicating matters, need following informations for judicial proof¹:

- That the alleged occurrence did take place.
- That the accused had the opportunity to cause the alleged occurrence.
- That the accused had the means and capacity to accomplish the act.
- That the accused had the motive to commit the crime.
- That the accused did commit the crime.

Thus, they need information about the occurrence, about the men involved and about the circumstances and the prevalent situations at the time leading to the occurrence. The information on most of the above aspects is important, in most of the cases, to

arrive at the truth. Forensics collects or helps to collect the information, provides the information through evaluation of clue materials, handles the involved men (the culprit, the victim or the witnesses), and assesses the prevailing situations, and puts the total evidence convincingly before the court to reveal the truth. In the process it provides answers to above mentioned basic questions.

Forensics, in its effort to keep ahead of the law breakers, has to continue advancing on all the war fronts. A peep into the current advance arsenal of Forensics may be useful to win the individual battles in the fight against crime. Here is, therefore, a bird's eye-view of the advancing fronts in Forensics.

Background

At the time of Independence, and even for some years thereafter, there were few, in India, who had heard of Forensic Science or Forensic Investigations. The first laboratory to adopt the name of Forensic Science Laboratory was the West Bengal Chemical Examiner's Laboratory. But it was just a change in name only. It continued with the work of locating and identifying poisons and stains (whether of blood or of something else). If they were found to be bloodstains, they were sent for serological examinations to the Imperial Serologist to the government of India. It took years before the laboratory assumed other functions of Forensics.

The name of Forensics was not known to many and there was the fear of the unknown. Therefore, extremely limited forensic investigations were being done. In addition to Forensic Serology and Forensic Toxicology, the other fields of forensic investigations were:

¹Anant Chintaman Lagu v State of Bombay; 1960,Cri. L.J. 682 (Supreme Court)

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- ❖ Fingerprint identifications
- ❖ Handwriting Identifications
- ❖ Firearm identifications

Fingerprints investigations were done in Fingerprint Bureaus, under the police departments directly. The fingerprint experts were usually police officials. Their duties were:

- ▲ To identify fingerprints.
- ▲ To visit the scene of crime to develop latent prints, collect and then compare them.
- ▲ To maintain fingerprint records of the criminals and to search the record to identify the recidivist.

The identification of handwriting was done mostly by Government Examiner of Questioned Documents (GEQD), in an institution created by the central government at Shimla, almost in the beginning of the last century (1906). Some CID sections, in some states, also had handwriting experts for handwriting examination. All of them examined handwriting only. They did not tackle other types of documents problems, uptill recently.

The linkage of firearms with fired ammunition was also carried out in some CID scientific sections. Other aspects of Forensic Ballistics were not handled.

The scientific facilities were next to nothing and the scientific findings were highly elementary and subjective in most of the cases. For example, there was only one laboratory to examine blood: the Imperial Serologist to the Government of India. It examined blood from all over India. The results were disastrous. Its reports used to read something like this:

- a. *"The stain material was found disintegrated"* in most of the cases.
- b. *"The stain was of blood but species of origin could not be determined"*; in most of the remaining cases.
- c. *"The stain is of A, B, AB or O group"* in less than one percent cases!

Similar were the findings in other forensic investigations. Consequently, many a trial judge did not hesitate *"to explode the myth of scientific evidence once for ever"*.

Metmorphosis

During the last fifty years Forensics has undergone a sea change: scope-wise, technology-wise, certainty-wise, and acceptability-wise. Even the presentation of the forensic investigative findings uses hi-tech techniques like power presentation, video-films of the scene of occurrence and creation of virtual reality through animation films; to make them easily intelligible to all concerned. In reality Forensics, now digital technology Savvy has become an all-purpose new handmaiden, for all the wings of criminal justice system:

- i. It helps handle men, with absolute efficiency and without blues.
- ii. It handles scene of occurrence, present (live) or past; with meticulous care.
- iii. It has crossed all physical barriers to analyze, identify and compare even the tiniest clue material.
- iv. It has blazed into the courtroom with power presentations and virtual reality animation films of the occurrence.
- v. It has made a dent in the solemn calm of the courts to push in the Solomon's Audacity in fixing the truth.
- vi. It preempts the criminal.

Advances in Manhandling³

Interrogation

In India Forensics was nowhere Involved in the interrogation of men to get information, up till recently. Only the CBI had created a Lie-Detection unit in their Forensics laboratory when the laboratory was established in late sixties. But the assistance requisitioned for interrogation continues to be extremely limited. Frequent acquittals, pressure for successful investigations from the higher-ups and advent of high-tech crime have forced the investigator

Abstract

Forensics has made significant progress in all aspects of handling crime. Its advancing fronts are:

Better handling of crime. Advances pertain to participation of the scientist in the evaluation of the scene, in the video recording of the scene, locating and collecting the correct clues and on spot evaluation of these and in creating Virtual Reality of the scene and occurrence through animation films.

³ Pun (manhandling instead of man-handling is intentional: a reminder to the III Degree Methods

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to use scientific methods to extract information from the suspect, victim and witnesses alike. Besides, the courts have also promoted their use. They discouraged the traditional tool—the Danda, on the one hand, and urge the use of science to find the truth, on the other hand. So, use of science will be the rule rather the exception in collecting information from the involved persons in the coming times.

The subject (person under interrogation may be a culprit, a victim or a witness) provides information. Forensic tools and techniques help interrogation to extract truth from him, willy-nilly. The scientific methods are far superior to other modes in many ways. The latter often involve Third Degree Methods in one form or the other; sometimes it results even into custodial deaths. It invariably involves invasion on the privacy of the subject and assault on his dignity ignoring human rights. The innocent subject often “confesses” to a crime he or she has not even known under the traditional tool—the Danda. The whole process of breaking the subject to make reveal evidence is so disgusting!

Scientific Method

The scientific modes are more effective. Some courts now insist on scientific modes of interrogation⁴. Many a scientific techniques have come up and these are being refined daily. Prominent among these are:

i) **Narco-Analysis**

Narco-analysis is interrogation of a subject under specific sedation. Here a qualified medical practitioner administers the subject the needed dose of a hypnotic drug (Seconal, Pentothal or others). The drugs are called, in common parlance, as “Truth Serum”). The drug suppresses the reasoning power of the subject but it does not affect his or her memory or speech. Thus, interrogation of the subject in this sub-alert mental state brings out the truth. The technique is usually employed for the interrogation of the spies. However, it has been used to interrogate other criminals also. Telegi in Stamp Fraud case and suspects in Noida’s

Nithari multi-murder case where dozen of victims were raped, murdered and perhaps cannibalized were usefully interrogated using the technique.

Narco-analysis is an invasive technique. It has its limitations.

ii) **Psychological Detection of Deception (PDD)**

Psychological Detection of Deception (PDD) technique is popularly known as Lie Detection and the gadget used for the purpose is known as Lie Detector. It is one of the oldest scientific techniques (started in late first decade and early twenties of the 20th century). It has been extensively refined in recent years. Computer has been pressed into its service, which has eliminated most of its subjective element in the process of using the technique for finding the truth in an occurrence. In competent hands the PDD is of It is based on psycho-somatic principle: the body of the subject under interrogation, due to psycho-somatic effect, reacts to the questions to which he tells lies. The body reactions manifest in the form of increase in blood pressure, changes in heart beat, variations in breathing rhythm and change in electrodermal response, etc. These changes are recorded on a graph and studied. The truth is extracted from the lies.

The method is considered invasive and has its limitations.

Brain Printing

Brain Printing is a sequel to the Psychological Detection of Deception. It is well known that our brain stores the information gathered through our sense organs, actions or observations. If a person is shown an object he had used or come across while committing the crime, he recognizes it and the act of recognition activates brain’s electrical activity. Similar brain activation takes place if the subject is shown a scene which he has seen, created or participated in its creation. This increased

⁴ Gujrat High court’ Judgment.

Scientific interrogation. Forensics provides tools like Lie Detector, Brain printing and Narco-analysis for interrogation which are giving excellent result in finding the truth. They also dispense with the illegal and inhuman III degree methods.

Scientific tools for surveillance are working wonders to locate, track and apprehend the criminal.

Clue material analyses have undergone a sea change.



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electrical activity is recorded and studied. Usually, only those objects and scenes are selected for display, which are involved in the crime and are known only to the culprit. The electrical activity graph is recorded through an instrument called Encephalograph, attached to the head of the subject. It pinpoints the culprit, if he has participated in the crime. It also indicates the part he played in the nefarious act. If the subject has not participated in the crime actively, there will be no increased electrical activity.

Brain Printing has been utilized in another mode also: through Magnetic Resonance Imaging (MRI). The technique is based on the fact that during truthful conversation, the subject takes more time to tell a lie. The increased interval is recorded in the MRI graph.

The theory and the statistics relating to brain printing are being worked out to make the technique reliable and acceptable. The protagonists claim high all round efficiency for the technique.

Other Tools and Techniques

- a Remote Personal Assessment:** It is a covert Lie Detection technique. It uses microwaves or lasers to assess the stress on the person remotely, covertly.
- b Psychological Stress evaluator :** It uses a voice spectrograph to study changes in vibrations in the subsonic sound waves under interrogative stress when the subject tells lies in answer to question, to find the truth.
- c Criminal profiling :** It is criminal's profiling based on his action and behavior. His acts, behavior, mannerism and expressions are used to construct his profile.
- d Psycholinguistic Profile:** It is a profile of a criminal based upon his written and spoken words and text used by the criminal. Competent

Forensic Psychologist can draw a fairly accurate description of the possible criminal from the written or spoken (or both) words.

Some of the interrogative techniques have not yet crossed the Fries⁵ hurdle of general acceptance Rule:

"... in admitting expert testimony, deduced from a well-recognised principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the field"

Many a times the court has rejected the expert evidence in USA and India on the plea that the expertise has not achieved the general acceptance stage. One has to meet the situation (lack of general acceptance) more frequently today and in the coming times as the new scientific principles and technologies are coming up very fast and they take time to be generally known. USA Supreme Court has come to the rescue in a landmark decision, in Daubert's case⁶. It laid down:

- 1 ***"(General acceptance' is not necessary precondition to admissibility of scientific evidence under Federal Rules of Evidence; and***
- 2 ***"Rules assign to trial judge the task of ensuring that expert's testimony both rests on reliable foundation and is relevant to the task."***

Under the second clause, the courts do have the tacit duty to see that the principle and the technique:

- a. Have universal application, not limited to the case in hand.
- b. Are verifiable
- c. Have been published / reviewed.
- d. Have known rate of potential errors and it has been taken into consideration.

⁵ Frye v United States;293 F.1013 (D>C>Cir.1923)

⁶ William Daubert v. Merrell Dow Pharmaceuticals,Inc; 113 S. Ct. 2786 919930.

Now the tiniest clue material can be analysed, identified and compared. Tools and techniques like DNA profiling, Scanning Electron Microscopy, Spectroscopy, Pattern Recognitions, etc., with computers as their workhorse, have brought in the revolution in clue analyses. In addition, new tools for pre-emption, power presentation of evidence, creation of virtual reality, etc., along with the above mentioned tools and

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In India most of the courts have been following Frye's principle almost invariably and indiscriminately. But there is a change, thanks perhaps to the above decision, and to the judges who are now accepting the evidence deduced on basis of the new principles and discoveries. They are encouraging the new modes of Forensics interrogations.

Thus, Forensics has come up with modes and means which dispense with the inhuman and illegal modes and the evidence elicited but is free from bias, human error and manipulations. Formerly, the courts were wary to accept the above methods as the modes for judicial process. But seeing the futility, the inhumanity and illegality of the alternative in real practice and the commendable achievements and the humane approach of the scientific modes, they are now opting for the scientific interrogations and are even guiding the investigators to adopt these methods to reach at the truth⁷. The actual extent of use of the methods is a far cry from the need.

Forensic Psychology⁸

Application of psychology in the dissemination of justice is not utilized in India to any appreciable extent, except in interrogation (PDD-Lie Detection). However, it is a potent weapon in fight against crime and in handling criminals, especially delinquent juveniles, frightened and shocked witnesses and victims and even in handling some criminals. Advancing fronts in Forensic psychology may be listed here:

- ♦ To ascertain if the accused is fit to stand trial.
- ♦ To assess the mental state of the criminal (or others) whether he understands the implications of his act or of the proceedings.
- ♦ To ascertain the motive behind the crime.
- ♦ To assess the quantum of guilt of the culprit.
- ♦ To stabilize a nervous or emotionally disturbed victim to extract real evidence.
- ♦ To determine the nature and quantum of punishment-treatment to the criminal (first timer, delinquent juveniles and others).

- ♦ To alleviate the victim's trauma.

Forensic Psychology is also becoming handy in civil cases especially in family disputes including custody of child cases.

Surveillance

Surveillance and collection of intelligence was a goody-goody police affair in days gone by. It was performed, mostly by informers, on police pay roll. The police usually employed ex-criminals for the task. The informers kept watch on their erstwhile criminal colleagues and informed the police from time to time. The work was not taken seriously by either party. The collection of intelligence and surveillance of violent socio-political groups, the police personnel, in plain clothes, mounted the vigil. The information collected was reported to the higher authorities from time to time.

The criminals, in days gone by, were only few and mostly local. It was not difficult to keep them under surveillance. The situation has changed for the worse since then. It is deteriorating further with the passage of time. The traditional tools no longer work. The police, for intelligence and surveillance work, therefore, have turned to forensics for help in its efficient handling,

The traditional surveillance tools like wire tapping and manual or vehicular surveillance is being augmented by a new crop of electronic gadgets:

Optical Surveillance

In optical surveillance the instrument used are CCTV, Hidden Cameras, Telescopes, Telescopic Cameras, Night Vision Devices (Nighteye snooperscope, etc.). Tele-surveillance, satellite tracking tools (GIS) and remote sensing techniques are the in-things. They help to prevent smuggling or entry of saboteurs from across the border or for keeping an eye on the unlawful activities of certain groups of criminals at certain sites.

⁷ Dinesh Dalimia v State; 2006 Cri. L. J. 2401

⁸ RB Sharma v State; Jt 2005 (4) 123

techniques augur a new life-support to the tottering criminal justice system. It is hopefully believed and prayed for that the new generation of tools and technique ensure and expedite the dissemination of justice.



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Sound Surveillance

A variety of instruments are used in sound surveillance, which includes tiny microphones, transmitters, recorders, interceptors. But an intelligent chip has revolutionised sound surveillance. Powerful yet tiny chips are now available. They can be placed anywhere: even in the body of a person, in a vehicle or at the site of the assembly of the criminals to know their plan and the mode of action and take pre-emptive measure to prevent the occurrence. They are the last word for covert surveillance.

Miscellaneous

A variety of electronic gadgets is being used for electronic surveillance other than optical and voice surveillance. Intrusion detection devices, Radio Frequency Identification chips which can be inducted in the body or vehicles etc. overtly or covertly, are becoming indispensable to follow suspected vehicles or the suspected criminals in their flight from the crime scenes.

Identity

For unmistakable and irrefutable identity of a culprit, a victim or even a witness fingerprints were the main reliable mode. It did serve well to identify the recidivist. It had many limitations in other crime situations :

- a. These were not available in most of the situations.
- b. These were often found mutilated, smudged, overlapped, over-inked, under-inked or over-powdered.
- c. These were frequently partial.
- d. The clear details varied in the questioned and the standard prints, being partial prints from different regions of the same finger or thumb.
- e. The ridge details of the persons who carried out manual work were often not available, ridges being erased (rubbed off) due to friction with rough material or surfaces.

- f. The degree of rubbing affected the left over details, which varied from time to time. The variations caused confusion and uncertainty.
- g. The data for proof of identity is often inadequate.
- h. In "Lost and Found (dead bodies)" persons and in case of mass disasters, there were no standards available for comparison; the person could not be identified.

This is not so now. Thanks to DNA Profiling! The identity of a person, practically from any of his body materials can be established. The clue available for the identification may be a smear of any body fluid, a tiny skin or flesh piece, a hair or even a bone or nail piece he may have deposited on various articles (handkerchief, garments!) left at home or elsewhere! Not only his or her identity can be established, beyond reasonable doubt from any material from his body when standard sample of his body material is available but also when standard material from his body is not available. In the latter cases, body material from his blood relation (parents, brothers and sisters, sons and daughters, even cousins and uncles) can serve the purpose. It was not possible before the eighties. DNA profiling was developed only in the later part of the eighties! DNA profiling is the most important find of all times, in Forensics, for the definite identity of an individual.

Now all the criminals, all the victims or all the witnesses can be identified from a tiny amounts of body materials they happen to get exchanged inter se or leave it at the scene or on the entities involved in the occurrence: the weapon of offence; the vehicle used, the route(s) used, etc. Not only is the identity of the culprit established but the culprit-victim linkage, Modus operandi, the sequence of events, etc. are also being established routinely, through correct identity of the person involved, everywhere. The main advantages of the DNA profiling are:

Clue material for DNA profiling is available in most of the crimes, especially in serious crimes

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involving offences against person.

Clue material in very small quantities is required for analyses.

Contaminations of the clue materials do not interfere or prevent DNA profiling. For example, in gang rape all the culprits who deposit semen in the vagina of the victim or on her person or clothes can be identified without mistake.

The age does not affect the results unless the evidentiary clue is destroyed by the natural elements, human hand, animals or insects.

The evidence is certain and specific.

No other tool or technique has turned the table against the culprit as decisively as DNA profiling has.

Scene of Crime

Once upon a time, the Scene of crime was the fiefdom of the investigating officer only. To an extent, it is still his exclusive domain. However, the ever-increasing acquittals in criminal cases has brought in Forensics to the scene; and increasingly so.

It is said that success or failure of a crime investigation starts and ends at the scene of occurrence. Our investigators were and most of them still are unaware of the potentialities of the scene as a source of clinching evidence to link the criminal with the crime. It was considered a mere formality to visit the scene and record that it was visited. They did not recover substances of substantial evidentiary value from the scene. However, with the spread of knowledge of scientific methods to identify and link the criminal with the crime, the victim and the crime scene through the clues collected from the scene, often decisively, has given a boost for proper evaluation of the scene of occurrence.

Forensics at the scene helps in many ways:

- a. It helps to locate, evaluate and collect correct clues correctly to establish corpus delicti, to link the criminal with the crime, with the victim,

with the scene, with the weapon of offence and even with the vehicle used in the crime.

- b. It helps to verify the given version of the prosecution of the defence, of the occurrence and the sequence of events.
- c. It provides investigative leads to the investigators most of the times.
- d. Importantly, it brings the scene to courts of law through a video film (or the like) for the court's own appreciation and evaluation of the occurrence, even after months.
- e. Still more importantly it helps to recreate 'virtual reality' animation film to present the reconstruction of the occurrence effectively.

Forensics takes the following steps to evaluate the scene:

Formation of Crime Scene Teams (CST)

The Forensics assistance has been found so useful in the handling of the scene that most of the police forces in India are now employing forensic experts, as a routine, in handling the scene of occurrence, at least in serious crimes. They have organized CSTs. The team consists of a scientist, a photographer, an imaging expert (he may even replace a fingerprint expert) and other specialists as per need of the crime scene. The team has an efficient fast moving mobile laboratory. The team is kept ready to move at short notice. It proceeds to the scene immediately on receipt of the requisition. It helps the investigating officer in charge of the case in the total evaluation of the scene.

The team experts perform their assigned work. However, in some cases the exigencies of scene may need some other specialists (like medico-legal expert, ballistics expert, arson specialist, explosive expert, computer and IT expert, etc.). The required expert also visits the scene. Special specialists are kept on the panel (with their consent) and they proceed to the scene at short notice.



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IT and computer crimes are a new species of crimes. These crimes need special skill and knowledge. Special Crime Scene Teams have been organized by some police forces. They induct IT and computer specialist in CST.

Permanent Record

The CST creates a permanent record of the scene through photography or video coverage. A film (say a video film) records the scene in detail as soon after the occurrence as possible. Thus, a video record of the scene is created which can be viewed and evaluated months or even years after the occurrence. The video (or other film) can be displayed in the courtroom itself when the case for adjudication comes before the court. The court can see the scene in its nascent form and thus can appreciate the events of the occurrence for correct appraisal of the events. The investigator can also use the visual record to verify or modify his findings.

The photography and imaging expert reveal the latent evidence, records it, fixes its site and preserve its presence in irrefutable terms.

Reduction in Response Time

The CST is kept ever ready to proceed to the scene at short notice. It is located at a convenient place, central to the area it serves. Wireless network of the police keeps the control room informed at police headquarters about the various occurrences. They, in turn, inform the CST and others concerned with the case to proceed to the crime scene whenever required. The whole process takes only minutes if handled properly.

In cities, 'Flying Squads' play an important role in reducing response time. They are placed at strategic points, ever ready to move to the scene. They are familiar with the geography of the area and reach the scene soon after or even during the occurrence. They guard the scene and take other essential steps till the assigned or authorised investigator reaches the site.

Proper Documentation

The examination and evaluation of the scene is properly documented to preserve authenticity, integrity and continuity of the evidence collected from the scene through various logs:

- Administrative log
- Preliminary survey and description log
- Photography and sketching log
- Evidence collection, preservation and custody log.

Gone are the days when one had to depend upon scanty, often non-available chance fingerprints at the scene, often supplemented by illegal padding. The CST now locates, collects and preserve ample evidence of all types, in most of the cases, and dispenses with the illegal act of padding!

Clue Analysis

Clue Materials

Clue materials are of all hues, of all sorts, of all sizes: From a whiff of a scent to trains and aeroplanes. These answer all basic questions about the occurrence: When, Where, Why, How, Who, Whom. These provide high quality information and establish corpus delicti, fix the identity of the culprit or of the victim (fingerprints, DNA profiles from body materials), identify the scene, the weapon of offence, the vehicle used in the incident and verify the versions.

The basics aspects of clue materials which make them unique and indispensable in the dissemination of justice are:

- a. Clue materials are always available in all cases as the culprit must exchange them inter se with the victim, with the scene, with the weapon of offence, with the vehicle, with the route and with articles which have come in contact with him or with his paraphernalia. It is impossible to imagine a situation, an occurrence, where there is no exchange of clue materials; however small the clue material may be but it must be there: Left (or deposited), picked up (and carried) or both by all entities involved in the crime and coming in contact inter se: The

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author has not been able to imagine, not to talk of finding through the decades of his involvement with them, a situation where there is no exchange of the evidential clues!

- b All clue materials are unique. In other words, no two clue materials are exactly alike. If we can link the clue material to its source, we link the criminal with the victim, with the scene, with the weapon of offence, with the used vehicle, etc. In short, we link the criminal with the crime decisively.
- c Forensic technologies have crossed all physical barriers and can analyze, identify, quantify and compare even the tiniest particle or the smallest amount of material made available to the technologist.

Modern Tools

The arsenal of modern forensic analytical tools and techniques for clue analyses is really formidable. Some of the important ones are:

Computers

Computers have taken over all the routine functions in Forensic laboratories with unthinkable speed and accuracy. It controls almost all the instruments. These compile and compare the data. These draw the inferences. It presents the data and the inferences in the form of a print out to the Forensic expert for check and utilization. These have finished all the drudgery of controlling the functioning of the instruments and compilation and comparison of the data. Thus, these prevent human error in the processes. It is true for all branches of Forensics. But the most dramatic vision for the layman is automation in fingerprints where a computer can carry out the comparison work (searches) of dozens of searchers (Fingerprint experts) working for dozens of days, in hours, if not in minutes. Automatic Fingerprint Identification System (AFIS) is the name of the software for the purpose. The Central Fingerprint Bureau has named the software (and the system) as 'FACTS'. It is an acronym of 'Fingerprint Analysis Criminal Tracing System'.

There is no Forensic institution worth the name which is not using computer controlled equipment.

DNA Profiling

DNA profiling, for definite identification of an individual, has surpassed all known techniques. It utilizes a large variety of clues: Any body fluid or body part, in any quantity, of any age can provide the DNA profile. Its linkage to parents, siblings, brothers and sisters and other blood relations has increased its utility manifolds. DNA has emerged as weapon colossal dimensions in Forensics to identify a culprit, a victim, an unknown body, mutilated or otherwise or to fix parent-sibling relationship!

The only drawbacks are its cost and time consumption. However, researchers are on the job to handle the hurdles.

Pattern Recognition

Pattern recognition technologies have invaded Forensics in a big way. It is needed every where;

- Access control to premises
- Protection of electronic instruments or documents
- Comparison of graphs, profiles and data charts
- Comparison of fingerprints, handwriting and other marks.

The simplest version of the use of pattern recognition was in the form of Magnetic Ink Character Recognition (MICR). It is still in use in banks, especially on cheques. Magnetic inks are used to create bank specific patterns. The patterns are identified through pattern specific reading devices. Now, thanks to digitization protocol more intricate patterns (fingerprints, signatures, facial features, retina pattern, voice pattern, even DNA profiles) are utilized to safeguard the confidential and secret data.

The use of pattern recognition for safe electronics is bound to increase in the coming times.



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Videography

Videography has revolutionized the recording of the scene of occurrence and has enhanced its forensic value manifolds. If the response time to reach the scene is not excessive and the video-coverage of the scene is done by a police related professional, the scene is preserved for ever and it can be taken to the court itself. A video film of the scene is a boon to all: The investigator, the counsels and above all, to the judge. It helps to evaluate the occurrence properly.

Videography is also being used in “sting” operations increasingly to pin the corrupt and other criminals. Its use for the purpose is bound to increase in the coming times.

The investigating agencies have not gone all the way for videography yet. But they are coming round to use it increasingly.

Scanning Electronic Microscopy (SEM)

Scanning Electron Microscopy through its multipurpose approach has become an indispensable tool in Forensic analyses. It is mainly used for surface studies. The high magnifications (of the order 10⁵) it offers, enable scientist to study the tiny details of the surface structures. Its 3-dimensional (3-D) view permits to appreciate the minute differences in the surface patterns. Its chemical analysis mode (through EDX) allows determination of the surface structure.

The technique is extensively used in evaluating tool and other marks and fine striations on all types of surfaces (fired ammunition, cut wires, etc.). It is indispensable in the analysis of Gun Shot Residues (GSR), stains, fibres, dust, paint, etc.

The SEM is a must for all Forensic institutions. Yet most of the Forensic laboratories, in India, do not possess it.

Additional Gadgets

Some other modern tools and techniques used in Forensic analyses which give service and results of high order are:

- Mass spectrometry, FTIR, Spectroscopy, NIR spectroscopy
- Chromatographic Techniques: TLC, GLC, HPLC, Etc.
- NAA
- Voice Spectrography
- Trace Elemental Profiling
- Digital photography
- Image Enhancement.
- Detectors for Narcotics, Metal and Explosives.

Advancing Thrusts in Court

Presentation of forensic findings in the court has undergone a sea change. Earlier, these were presented orally or in the form of a report, sometimes laced with illustrations. The report was (and is admissible) per se under Section 293 of the Cri. P. C., 1973 since 1974. The reports usually were bare without data, the basis of the report. The expert would visit the court only rarely when his services were requisitioned by the court to elaborate the report or furnish additional evidence in the case in hand. Now forensics has additional role in the court:

- a. It brings the crime scene to the court through video film or a movie.
- b. It provides a report on the detailed examination of the scene.
- c. It presents the findings in a power presentation mode.
- d. It helps the court to record ‘live’ evidence of a distant witnesses who cannot attend the court conveniently, through video-conferencing.

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- e. It provides computer graphics to illustrate evidence.
- f. It creates 'virtual Reality' to reconstruct the whole occurrence through animation films.

Advances in Pre-emption of Crime

Pre-emption of Crime

Pre-emption of crime has become a necessity of our times. The modern crime patterns, like suicide bomber in terrorist strikes, are so destructive and so demoralizing that the crime handlers find it an uphill task to bring the investigation to a successful conclusion. Besides, the investigations take a long time, a lot of manpower and long years to accomplish the task. In short, they involve large task forces and huge expenditure. Besides, they take long time. For example, Bombay serial blast took 15 year to announce part of the judgment. The masterminds of the blasts are still absconding!

The crimes cause tremendous loss of life and property. It should be better to pre-empt and prevent such crimes. Investigation and prosecution is, like a wild goose chase, often unproductive. Forensics has taken a giant leap forward to pre-empt such major devastating crimes. It helps to collect information on the impending man-made disasters from the suspected sources. Thus it:

- a. Stalls terrorist activities.
- b. Provides better handling of smuggling and smugglers.
- c. Undercuts scams.
- d. Prevents communal and political troubles.
- e. Provides wherewithal to monitor the movement of criminals or their vehicle.
- f. Helps to handle the corrupt covertly.
- g. Controls pseudo- political or violent religious movement like Naxalite movement or Terrorists trouble in Kashmir.

The possibilities of Forensics applications are almost unlimited. For example, one of the most serious problems India faces today are Naxalite uprising in Telangana, Chhatisgarh and Orrisa and the terrorist attacks in Kashmir and elsewhere. The problems have remained not only unresolved now for a long time, but these are also escalating. The continued success story of the terrorist organisations is due to their ability to 'vanish in the jungles, hills or mountains'. The authorities have now come to the conclusion that the hide and vanishing tricks of the terrorists must end if they are to handle the problem, to a finish. It is possible if their movements are tagged and followed correctly. They have tried the terrestrial modes but without substantial success. Now they are in for celestial surveillance, through satellites. A device called Geographical Information System (GIS) has been developed. It provides high resolution three dimensional images which can give out the hidden sites of the trouble groups and their strengths. The instrument penetrates through the jungle foliage, if there is one, and permits fairly comprehensive observations of the site. The device also provides continued navigation to the site. Thus, the security forces are enabled to locate, follow and handle the Naxalites and the *Jehadis* in their hideouts in the jungle or mountains and hills expeditiously and effectively. It is hoped the security forces clasp the forensics help expeditiously to finish the twin menaces which have taken and are taking a heavy toll of life and property.

ISRO provide the relevant Forensic GIS help.

Additional Forensics tools for pre-emption

The additional Forensics tools for pre-emption are :

- * Surveillance tools,
- * Interrogation tools,
- * Miscellaneous electronic gadgetry.

These instruments are becoming handy to pre-empt the criminal by securing information, while



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they are planning, and collecting tool for the nefarious tasks, or assembling to arrange manpower for the act or while they are initiating the crime process. Many a crime can, thus, be prevented by the pre-emptive action: Arrests of the suspects and seizures of the tools of ensuring crime.

Cyber and information technology crimes are other emerging daunting crime areas. The cyber crime may be committed in one country and its fruits may be harvested in another country. The cyber race of the keepers of law against the breakers of law is a never ending race. Information technology crimes include

its applications in the field of e-documents, digital signatures, e-commerce, e-banking, net-banking, m-banking, tele-marketing and e-money in its various forms (money cards of all sorts, ATMs, digicash, etc.). The use of the electronics in the various form of online business is yet limited in India. However, the field has to be watched properly. If the working of e-trade in the West can be any guide, e-frauds and fraudulent e-documents are round the corner. Prevention of e-crime through pre-emption would be a better proposition compared to their investigations and prosecutions.

Key Words

Snake,
Snakebite,
Venom,
Colubrine,
Viperine,
Antivenin,
Fangs,
Detection,
Analysis,
Site of Bite

Snake Bite Poisoning A Forensic Review

Mithilesh Jha¹, A K Jaiswal², T. Millo³ & M Gupta⁴

Introduction

Who is not aware of snakebite cases? Whether literate or illiterate people all are aware about the effects of snakebite, like painful sensation and its lethal effects. Snakebite can cause pain, paralysis, haemolysis, hemorrhages, convulsions, coma and death. The extent of effect of snakebite is dependent on the amount of venom injected, types of snake, the site of bite, etc. In our country, about 20,000 deaths occur per year due to snakebite. Deaths from snakebite are common in tropical and sub-tropical countries (30,000-40,000)(4). Snakebite should be treated as an emergency (10). Snakebite should be

considered as different from snakebite poisoning. The snakebite poisonings may occur from actual bite, through injection or by absorption of venom through the cuts and scratches. Normal snake biting occurs accidentally but homicidal as well as suicidal uses of snake venom have been reported. There are instances where unnatural death due to hanging, murder, poisoning etc. has been alleged to be caused due to snakebite to escape the crime. It becomes challenging for the forensic experts to ascertain the snake bite cases. The forensic expert have to opine about cause and manner of death to help the prosecution. This article gives a forensic insight into snakebite and snakebite poisoning cases.

Table 1 : Characteristics of three family of poisonous snakes in India

Features	Elapidae	Hydrophidae	Viperidae
Occurrences	Hills, forests and also in old buildings.	Vicinity of the sea coast	Especially Ill hilly area.
Reproduction	Oviparous	Oviparous	Ovoviviparous
Head	Same width of neck	small	Triangular and wider than the neck
Pupil	Circular	Circular	Vertical
Fangs	Interiorly situated but it is difficult to see them because they are short and covered with a fold of mucus membrane and they are grooved	Posterior situated, short and very delicate	Interiorly situated long, movable and canalized just as a hypodermic needle. They are easily seen.
Tail	Cylindrical	Ruddle like flat and help in swimming	Tapering
Biting	Usually they are offensive but they cannot efficiently bite through clothing.	They are non-offensive in nature because of delicate and short fangs.	They can inject sufficient venom even through the clothing.
Venom	Neurotoxic	Myotoxic	Haemotoxic

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Snakes belong to the order Squamata, of class Reptilia and suborder Ophidia. This suborder comprises all true snakes. The followings are the characteristics of true snake.

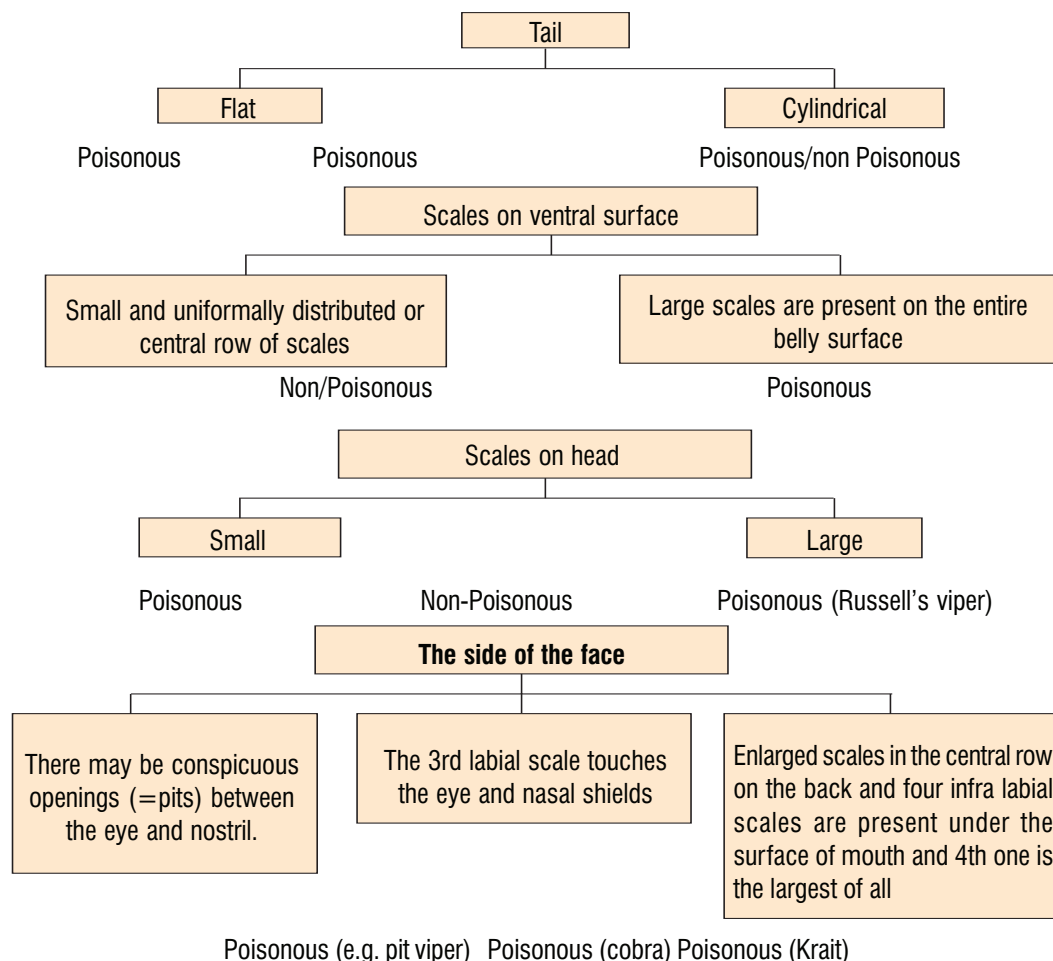
- Absence of limbs.
- Absence of ear opening.
- Absence of an eardrum.
- Absence of a sternum .
- Absence of urinary bladder.
- An immovable transparent eyelid covers eyes.
- Long bifid tongue.
- The skin is dry scaly and may be molted several times per year.

Specific Distinctive Characteristics of Three Poisonous Snake Families of India

The comparative features among the poisonous snake families in India can be given in table 1. in which the important body parts has been described

Morphological Features for Identification of Poisonous/ Nonpoisonous Snakes

Snakes can be identified as poisonous or non-poisonous on the basis of specific morphological features. If the identification of snake is established, the treatment becomes easy and lifesaver. To identify them, it is essential to examine step by step starting from tail to other characters.



Abstract

In the present article an attempt has been made to review snake bite poisoning cases. It provides detailed facts about the morphological identification features of poisonous and non poisonous snakes, clinical symptoms and signs, chemistry of venom, management aspects, autopsy findings, sample collection, detection of venom and its medicolegal significance.

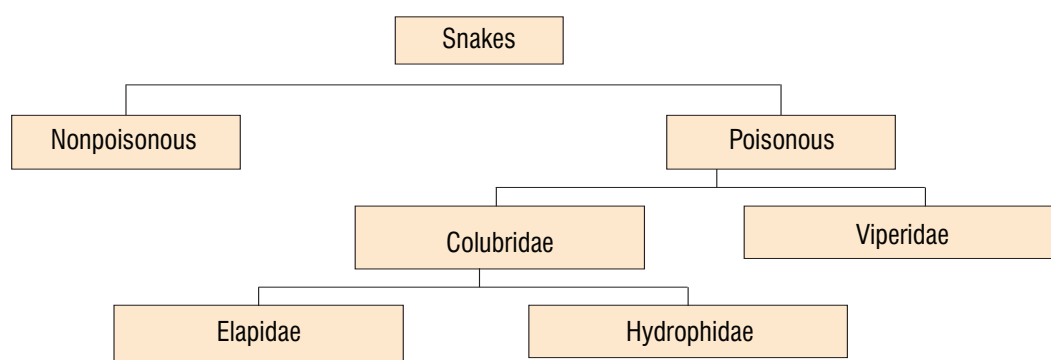
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Medico-legal Classification

There are about 2500 species of snakes in the world. Out of which 216 species are present in India. Only

25 species of them are known to be poisonous(5). A medicolegal classification chart is given here:

Commonly encountered snakes in biting cases are



tabulated along with their scientific name in table 2.

Table 2 : Scientific and common names of poisonous snakes

Family / Sub- family	Scientific name	Common name
Elapidae	Bungarus fasciatus Bungarus caruleus Bungarus multicinctus Ophiophagds~Haimah Naja naja	Banded krait Indian krait Many banded krait King cobra Indian cobra
Hydrophidae	Laticula semifasciata Laticula laticula Laticula colubrina	Sea snake Sea snake Sea snake
Viperidae	Vipera russelli	Russell's viper

Chemistry of Snake Venom*

Poisonous snakes secrete the venom from highly modified pair of poison glands, which is a modification of parotid glands of other vertebrates. This gland is situated below and behind the eye on each side of the head. Normally, the venom is stored in the large alveoli present in the gland. The venom passes through a duct to the base of two grooved and tubular teeth called as fangs (26) and thus ejected out. In fresh state, venom is clear, transparent and amber tinted fluid. In dried state, it is yellow granular mass and may retain its activity for many years. The dried venom has

* A digestive Juice of Snake

characteristic needle shaped crystal structure, which is easily water-soluble.

In fact, snake venom is a complex mixture of proteins and different specific enzymes, which have specific function (especially to neutralize, inactivate, paralyze and digest the prey). The venom contains some or more amount of cardiotoxin, neurotoxin, toxalbumin, agglutinin, fibrinolysin proteins (9). Sodium, Potassium, Manganese, and Nickel are also present in the venom to give its potentiality. The major constituents(28) are detailed below:

Proteases

Most of the snake produces venom-containing Proteases. It is present predominantly in the venom

This article will be of great help to treating physicians, autopsy surgeons and forensic toxicologists.



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of snakes of Viperidae family. But colubrine venom also has proteases. They catalyze the hydrolysis of proteins thus they result into marked tissue damages at the site of bite. Certain Proteases are found to catalyze the formation of Thrombin from Prothrombin.

Hyaluronidases

They have been reported in almost all snakes venoms, studied. They hydrolyze the Hyaluronic acid gel of the spaces between cells and fibers, particularly in the connective tissues. Now, other components of venom can enter into the cell or tissues, easily.

The edema and swellings at the site of bite is related with Hyaluronidases action

Cholinesterase

Colubrine venoms show this component more dominantly as compared with Viperine.

Cholinesterase catalyzes the hydrolysis of Acetylcholine to Choline and Acetic acid.

In fact, Cholinesterase is the Acetyl cholinesterase. They prevent the accumulation of Acetylcholine at cholinergic synapses and at neuromuscular junction. thus the Acetylcholine receptor gets blocked. This effect is similar to that of high doses of Curare or Nicotine.

L-amino oxidases

They are nonhydrolytic digestive enzymes. Their function is associated with digestion.

In fact, they are nontoxic components of snake venom. The yellow colour of dried venom is probably due to this constituent.

Phospholipases-a

They are known to catalyze the hydrolysis of lipids and they are responsible for the haemolysis caused by snake venom. Human and dog red cells are more susceptible than cow or goat red cells(15). They act in two ways-

- ❑ Directly they act on phospholipids of cell membrane and cause their hydrolysis
- ❑ Indirectly they produce lysolecithin by acting on plasma lecithin present in cell membrane.

But indirect way of action of phospholipases is affected by the four determinants i.e. plasma lecithin level, protective effects of plasma proteins, sensitivity of RBCs to lysolecithin and the influence of spleen.

Phospholipases-b

They are known to catalyze the hydrolysis of Lysolecithin to Glycerophosphate and fatty acids.

Phospholipases-c

They catalyze the hydrolysis of Phosphatidyl choline to Diglyceride and Choline phosphate.

Phosphatases

They catalyze the phosphate bonds in nucleotides. Six major types of phosphatases are as follows-

i. Phosphomonoesterase

It is Ortho phosphoric monoester phosphoric hydrolyses.

ii. Phosphodiesterase

It is Ortho-phosphoricdiester phospho-hydrolyses. It releases nucleotides from polynucleotide thus acts as an exonucleases. ATPase and DPNase activities are also related with Phosphodiesterase. Primarily cardiac system of the prey is influenced by this.

iii. 5' Nucleotidase

It is the most active phosphatases in the venom. Actually, it is Ribonucleotides phosphohydrolase, which catalyzes the hydrolysis of 5/mononucleotides and produces Ribonucleoside and Orthophosphate.

iv. ATPase

It catalyzes the hydrolysis of Adenosine tri phosphate and thus interrupt the supply of energy fuel used by the prey. Besides above enzymes the venom contain some or more amount of cardio toxin, neurotoxins, toxalbumin, agglutinin, fibrinolysin proteins, Sodium, Potassium, Manganese and Nickel are also present in the venom to give its potentiality.

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v. *DPNase*

vi. *Endonuclease*

Fatal Dose in Snake Biting Cases

Experimentally, it has been shown that venom of all snakes are not of the same potency. But, their potentiality varies according to species, sex and age as well as season and region of their occurrence. The snakes, which have recently emerged from hibernation, will produce more potent venom. It has been found that the snakebite is more fatal in summer

than winter (15). The fatality of snakebite is directly associated with the physiology of milking of venom and their compositions. The nocturnal (14) bite has been found to be more effective than that of diurnal. In fact, the age of person is also one of the important determinant of the extent of toxicity. The fatal dose is determined as the amount of the dried weight of venom in milligram per kilogram of the animal(30). As an average the amount of fatal dose of venom (dried weight) obtained are shown in table 3.

Table 3: Fatal Doses of Snake Venom (30)

family / Sub-family	Name of Snakes	Dose (mg per kg)
Elapidae	Indian krait	0.07
	Many banded krait	0.10
	Indian cobra	0.28
	King cobra	1.50
	Banded krait	3.00
Hydrophidae	Sea snake	0.08
Viperidae	Russell's viper	0.06

Besides above data table 4 shows the average dry weight of lyophilized venom in one bite.

Table 4: Amount of Venom injected per bite

family / Sub-family	Name of Snakes	Dose (mg per kg)
Elapidae	Indian krait	500
	Indian cobra	35
	King cobra	25
Hydrophidae	Sea snake	10
Viperidae	Russell's viper	200

Table 5: Fatal period in poisonous snakes

Famiuly/Sub-family	Minimum	M
Elapidae	12 minutes (Naja naja)	Less (Bunga careuleus)
Hydrophidae	No data	More than (Laticul
Viperidae	Less than 3 hours (Vipera russelli)	M hours arietanu.



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Fatal Period

If snake venom is intravenously injected, instantaneous death may occur.

Otherwise in actual snakebite cases it varies with different families of, and ranges from 12 minutes to more than 72 hours(30)

Tables shows the maximum and minimum time required to cause death

Signs and symptoms

Although, the effects due to snake bite poisoning depends on the age of victim and potency (main toxic constituent) of the venom injected into body the biting surface may be bare or hidden under clothing and thus affect the degree of poisoning. The most commonly manifested signs and symptoms are as follows :

Colubrine

Elapidae (neurotoxic effects)

Neurotoxin and cholinesterase is the predominant constituent and it affects severely the nervous system of the victim. Initially, 3rd, 4th and 6th cranial nerves are affected. But 10th nerve is also affected later on (15). Finally, the muscular paralysis and respiratory failure causes the death of victim (20.)

Burning, tingling pain, irritations, redness inflammation, swelling at the site of bite, (Mild local Symptoms)
Constitutional symptoms After minutes to 2 hours, the following symptoms are noticed-Lethargy, giddiness.
Nausea, Vomiting, drowsiness, vision becomes blurred.
Muscles start to weaken and spread gradually throughout the body. Ultimately, the patient is unable to walk due to paralysis of limbs.

Lips, throat, and tongue muscles are also paralyzed. Hence swallowing and drinking becomes difficult. Drooping of neck is very common, due to paralysis of muscles of neck.
Excessive salivation takes place and, the saliva is collected in mouth and forth appears from victim's body and gives characteristic features to the venom of elapid snake.
Breathing continues but later becomes laboured.
Severe abdominal pain and convulsion are also noticed
Finally death occurs. The victim shows consciousness till the death, normally, there is no affect on the blood pressure of the victim.

Hydrophidae (myotoxic)

With only few differences, the victim of sea snake also shows almost all symptoms like that reported in the neurotoxic snake biting (15). The signs and symptoms are shown below.

Feeling of sharp pricking, pain
After 1-2 hours, victim starts to show constitutional symptoms like lethargy, drowsiness, giddiness, nausea and vomiting
Site of bite becomes painless after some time.
Discoloration of urine is reported. Myoglobinuria occurs; Serum transaminase level is increased.
Due to leakage of potassium ion, hyperkalaemia occurs and it causes muscular damages (myositis)
Respiratory muscles become weak and affect vital process of respiration followed by death
Sense is maintained till death. Blood pressure of the patient does not get affected.

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Viperine bite (vasculotoxic)

Haemolysin and Phospholipases are present in the viperine venom, which results into the intravascular haemolysis (25) and death occurs due to circulatory failure (in early phase) and due to hemorrhagic and hemolytic complication (in later phase) (15).

Local symptoms- Tingling pain, swelling, large tissues destruction
Oozing of bloody serum from the site of bite
Discoloration of the site of bite
Ecchymosis is seen at the site of bite
Constitutional Symptoms (after few seconds to 20 minutes)
Skin of the victim becomes cold and clammy and pulsation becomes feeble and imperceptible blood pressure falls.
Pupils become dilated and are not light sensible
Hemorrhages from natural orifices (like nose)- and gums, nausea and vomiting, blood also appears in urines (14)
Pus formation and discharging is very extensive (suppuration)
Life-threatening gangrene (i.e., decayed death of tissues due to insufficient vascular supply) may commonly be seen
Hyperpnoea (abnormal deep and rapid breathing) is also common constitutional symptom.
Patient becomes unconscious

Medico-legal Significance

Poisoning by snake bite is generally accidental. But there has been rare instances where people have used snake venom to poison cattles and to mimic suicide or homicide cases for snake bite. The forensic medicine expert has to rule out snake bite case in such situation and in fatal cases a postmortem might have to be conducted. Snake venom is poisonous only when injected subcutaneously, intramuscularly or intravenously,

and has no ill effects when taken by the mouth as the venom is not absorbed from the gastric mucous membrane

Species Diagnosis

If the dead snake has been brought, it can be identified. Otherwise it can be inferred indirectly from the description of the snake and the clinical syndrome of symptoms and signs.

Diagnosis of Snake Bite

a) Early clues that a patient has severe envenomation (32)

- i) Snake identified as a very poisonous one
- ii) Rapid early extension of local swelling from the site of bite
- iii) Early systemic symptoms: collapse (hypo nausea, vomiting, diarrhoea, severe headache, heaviness of inappropriate drowsiness or early ptosis/ophthalmoplegia
- iv) Early spontaneous systemic bleeding
- v) Passage of dark brown urine

b) 20 minute whole blood clotting test (20 WBCT)

It is an useful test and informative bedside test (32). In So diagnostic of viper -bite cases and rules out an elapid bite time is greatly reduced.

1. Place a few ml of freshly sampled venous blood in a small glass tube.
2. Leave undisturbed for 20 min at ambient temperature.
3. Tip the vessel tube.
4. If the blood is still liquid (unclotted) and runs hypofibrinogenaemia (incoagulable blood) as a result consumption coagulopathy.

c) Conventional Method

There are some conventional methods to diagnose snake venom. It may be helpful for late confirmation but these are not management. It is known that the colubrine



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venom contains cholinesterase and viperine venom contains thromboplastin but no cholinesterase and therefore, bite surface can be washed properly with 0.2 ml Saline and these washings can be used for various testing these substance.

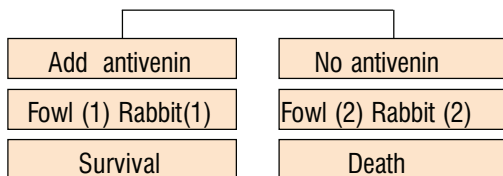
1. Activity of Cholinesterase and Thromboplastin

The aqueous washings are subjected to test cholinesterase and thromboplastin.

Result: positive result (5) for thromboplastin indicates positive result for cholinesterase indicates colubrine bites.

2. Toxicity test (19,29)

Aqueous washings from the site of bite is injected.



Result: This indicates that the aqueous washing contains snake venom(27) and confirms the case of snakebite.

Immunological diagnosos of snake (20)

Principle -mammalian body shows a specific immune reaction

The immune system recognizes the foreign bodies as antigens. According to the chemical structure of antigens, WBCs (especially B-lymphocytes) produce antibodies which is capable of binding-up with antigens because antibodies posses specific binding domain. It is just like a lock key mechanism. Thus, the antibodies can precipitate out the antigens snake venom) by forming an insoluble complex.

Requirements for the precipitin reaction:

- Normal saline solution
- temperature- 37°C

- Antiserum
- Soluble antigens
- pH must be 6.6 to 8.2.

a) Precipitin test tube method

We take 4 or 5 (may varies according to the varieties of snake of that region) precipitin tubes. Precipitin tubes are placed vertically and labeled. Extract of aqueous washing is put in each of the tube. One drop of antivenin (Elapidae, Hydrophidae or Viperidae) is added along the tube walls and left undisturbed for thirty minutes at room temperature. White precipitate ring is visible at the interface of the two solutions.

b) Process of gel diffusion technique (18)

- 100mg of agar (or Agarose) powder is mixed with 10 ml of normal saline in a beaker.
- The solution is heated.
- On the complete dissolution of agar, the solution is poured over in a properly labelled disposable Petri dish or glass slide to make a 1-2 mm thick agar layer.
- Agar is allowed to be solidified 5.Wells are punched in a specific manner
- Wells are punched in a specific manner
- The bottoms of the wells are sealed with dilute agar (0.5%) solution.
- The central well is filled with the extract of the sample and peripheral wells are filled with different antivenins.
- Petri dish or the glass slide is covered and kept in a moist chamber for 1-4 hours or overnight.
- Precipitation arcs are examined.

c) Cross over electrophoresis technique

It can be used to detect and identify the snake species. It gives the accurate and reliable result rapidly. Here we use Agrose gel and tris-glycine buffer. The value of pH is maintained at 8.6 (1). Antibodies of only

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those snakes are tested which are commonly found in the region (7, 8).

It is performed on the standard and case material after the method of Culliford (2).

Electrolyte: water barbital buffer (1:1); pH=8.6. Medium: 1 % Agar in Barbital, 7.5 cm plates, 12V\cm.

Serial dilutions of each venom or extract from 1 to 1/2048 are run against each of the antisera. This method gives result qualitatively as well as quantitatively. Sensitivity of this method is also 10-20 fold that of the immuno-diffusion method.

Treatment in Snakebiting Cases

First Aid treatment

It is carried out immediately or soon after the bite, before the patient reaches the nearest hospital.

Aims of First Aid(32)

- i) Attempt to retard systemic absorption of venom.
- ii) Preserve life and prevent complications before patient can receive medical care.
- iii) Control distressing or dangerous early symptoms of envenoming.
- iv) Arrange the transport of the patient to a place where they can receive medical care.
- v) Above all, do no harm.

Recommended first aid methods :

- i) Reassure the victim who may be very concious. To avoid death due to fright, the patient must be reassured that (i) all snakes are not poisonous, (ii) even poisonous snakes are not fully charged with poison always, and (iii) every snake fully charged with poison cannot inject a lethal dose always(12).

- ii) Immobilise the bitten limbs with a splint or sling.
- iii) Consider pressure immobilisation for elapid bites.
- iv) Avoid any interference with the bite wound as this may introduce infection, increase absorption of venom and increase local bleeding.

There are several concepts to treat the victim of snakebite. These may vary from case to case .The identification of snake is important if it is available. The patient must be taken to the nearest hospital, where the proper antivenin can be administered.

Antivenom treatment

Antivenom should be used only in patients in whom the benefits of anti venom treatment are considered to exceed the risk (adverse reaction).

Indications for antivenom

Antivenom treatment is recommended if and when a patient with proven or suspected snake bite develops one or more of the following signs.

- a) *Systemic envenoming.*
 - i) Haemostatic abnormalities: Spontaneous systemic bleeding, coagulopathy, or thrombocytopenia.
 - ii) Neurotoxic signs: ptosis, external ophthalmoplegia, paralysis etc.
 - iii) Cardiovascular abnormalities: Hypotension, shock, cardiac arrhythmia, abnormal ECG.
 - iv) Acute renal failure: Oliguria, anuria, rising blood creatinine/urea. v) Supporting laboratory evidence of systemic envenomation.
- b) *Local envenoming*
 - i) Local swelling involving more than half of the bitten limb (in the absence of



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tourniquet), swelling after bites on the digits (toes and especially fingers).

- ii) Rapid extension of swelling.
- iii) Development of an enlarged tender lymph node draining the bitten limb.

Administration of antivenom

Antivenin therapy is the cornerstone of snake bite management worldwide. It is the immunoglobulin purified from the serum or plasma of a horse or sheep that has been immunised with the venoms of one or more species of snake. It may be monovalent (activity against only one species of snake) or polyvalent (activity against two or more species of snake). It neutralizes the circulating toxins. In India, the polyvalent anti snake venom serum (PASYS)(16) is prepared at Haffkine Institute, Bombay and is available in the form of lyophilized powder in an ampule. The strength of polyvalent antivenin is such that 1 ml. of it will neutralize 2 MLD of king cobra venom (24). The clinical status of the patient and the offending snake species should guide antivenom therapy. Antivenom should be given by the intravenous route whenever possible. Epinephrine (adrenaline) should always be drawn up in readiness before antivenom is administered to treat any reaction. Normally, reconstituted freeze dried antivenom or neat liquid antivenom is given by slow intravenous injection (not more than 2ml/minute). The initial dose of antivenin depends on the initial severity of the bite. Russell recommends 3-5 vials for minimal case, 6-10 vials for moderate case and at least 10 vials for severe case. Half of the original dose of P/ASVS can be repeated at every two hours interval, if needed further. But specific antivenin is most valuable when the snake is identified. Since the type and amount of the antivenin is specific, the use of antivenin without knowing the species of snake may be harmful to the victim.

Therefore, specially trained and competent physician should use the antivenom. Antivenom can neutralize the circulating toxin only and not the toxin fixed in tissues. Snake inject the same dose of venom into children and adult. Children must, therefore, be given exactly the same dose of antivenom as adults. The clinical symptoms and complications should be treated accordingly.

Postmortem Examination

When a dead body (in suspected snakebite and snakebite poisoning case) is brought at mortuary, the authorized medical officer must go through step-by-step examination carefully to give the PM report.

a) Examination of snake

If the Snake was killed it must be examined to identify whether it is poisonous or non poisonous

b) Investigating officer's report (inquest papers)

The report furnished by the investigating officer (IO) often provides circumstantial evidence like eye witness statements, sample of the killed snake for identification.

c) Study of hospital treatment papers

If the deceased of snake bite case was admitted in the hospital, then the detail case sheet (look for clinical history, findings and laboratory reports suggesting snake bite case) must be looked into, from which we can get important lead to the investigation.

d) External Examination

i) Presence of fang marks

In case of poisonous snakebite, the snakes have to inject poison into the victim's body to cause death. The lesions due to snake bite are essentially teeth bite marks. In case of non-poisonous snakebite one or two rows of small teeth marks are seen. If two large grooved or tubular teeth fangs) marks are visible, it indicates

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poisonous snakebite. The fang mark may so small that these may be seen only with a lens. The punctures may vary from 1.2 cm deep in colubrine to 2.5 cm deep in viperine bites(3). These wounds are not sharp but lacerated punctured in nature. In some complex cases, it may be possible that snake venom was injected through open wound or scratches or otherwise. Here no fang mark will be seen.

ii) Site of bite

The condition of site of bite must be examined properly. There may be swelling, oozing of bloody serum, haemolysed blood and cellulitis in the area of bite. There are less local reaction and swelling in of colubrine bites and more local reaction with swelling in viperine bites.

iii) Victim's face

Evidence of frothing discharge from victim's mouth may be seen in cobra biting(14)

e) Internal examination

Internally in case of cobra bite, pulmonary oedema is commonly seen. In viperine bite there may be haemorrhages in the organs and in the undersurface of serous or mucous membrane of body orifices and solid clots in the vein due to fibrin ferment. There can be haemorrhagic interstitial nephritis, toxic proliferative nephritis, intracerebral haemorrhage and necrosis of liver.

Postmortem Sample collection

- ❑ Take aqueous washings of bite area by a clear cotton swab.
- ❑ Blood serum or blood of victim is also useful sample for the analysis of snake venom.
- ❑ Skin portion with the underneath muscle tissue around the bite area must be taken with a control sample from the opposite normal site and sent to the laboratory for analysis.

- ❑ Viscera are not suitable for detection of venom. (Again it may be sent to the laboratory, if necessary to confirm the presence of other poisons, which may be possible in complex cases).

Opinion in Snakebite case

Based on external and internal examination as well as other investigation reports opinion as to cause and nature of death is to be given. The opinion must be clear, concise, to the point and based on scientific analysis. Final opinion may be kept reserved for the time being till the receipt of the result of the forensic science laboratory analysis of the biological samples.

References

1. **Biological Methods Manual.** Metropolitan Police Forensic Science Laboratory, 109, Lambeth road, London, England, 1978 :2-88,94.
2. Culliford, B.J. "The Examination and Typing Of Bloodstains In the Criminal Laboratory", US Dept. of Justice P.R. 71 (7), 1971 :62.
3. Franklin CA. "Modi's Textbook of Medical Jurisprudence and Toxicology", 21 st Edition, NM Tripathi, Pvt. Ltd. Bombay, 1988, 169-174.
4. Faust, EC. "Animal Agents and Vectors of Human Disease", Lea and Febiger, Philadelphia; 1955 :400.
5. **Forensic Toxicology Manual.** Directorate of Forensic Science, MHA, Govt. Of India, New-Delhi, 2005 :287-291.
6. Jimenez-porras, M. "Biochemistry of Snake Venoms", *Clinical Toxicology*, 1970; 3(3):389-431.
7. Khaire, A. et al. **A list of Snakes in the neighbourhood of Poona Maharashtra with some observation.** Geobios New Reports (4), 1985: 12114.



Snake Bite Poisoning - A Forensic Review

8. Khaire, A et al. **Clinical Profile of Cases of Venomous Snakebite in Sassoon Hospitals**, Pune, India, Proceedings of 1st Asia - Pacific Congress on Animal, Plant and Microbial Toxins held in Singapore, P. Gopalkrishnakone, C.K. Tan, 1987:20.
9. Knight, B. 'Suicide By Injection of Snake Venom' *Forensic Science International*, 1977: (10): 141-145.
10. Knight, Bernard, Signal ML, and Sahi BV: "HWV Cox Medical Jurisprudence and Toxicology", 6th Edition, The Law Book Company-(P) Ltd, Allahabad, 1997:720-722
11. Kumar Ashok, Mathur Girish, Arora BB, and Malik Shaloo. **Detection of snake venom in biological materials**, Proceedings of 14th all India Forensic Science Conference, 2004:20-21.
12. Lahiri SK. "Elements of Medical Jurisprudence", 4th Edition, Law Book Society, Wellington Square, Calcutta.
13. Marsden, ATH and Reid HA. 'Pathology of snake poisoning', **British Medical Journal**, 1(1290), 1960.
14. Modi NJ. "Modi's Textbook of Medical Jurisprudence and Toxicology", 20th Edition, NM Tripathi Pvt. Ltd. Bombay, 1983:627-632.
15. Nandy A. "Principle of Forensic Medicine", New Central Book Agency, Calcutta, 1995:531.
16. Pandav VS, Ghumatkar SV, and Gaikwad, LB. **Simultaneous Detection of snake Venom in Unknown Sample by envenomation and Neutralization studies on Mice**, Proceedings of 14th All India Forensic Science Conference, Hyderabad, 2004:7-13.
17. Parikh CK. "Textbook of Medical Jurisprudence and Toxicology", CBS Publishers, Bombay, 1995:812.
18. Parikh CK. "Textbook of Medical Jurisprudence and Toxicology", CBS Publishers, Bombay, 1998:627.
19. Parikh eK. "Textbook of Medical Jurisprudence and Toxicology", CBS Publishers, Bombay, 1998:811
20. Pochanugool C. et al. "Clinical Features of 37 Non Antivenin Treated Neurotoxic Snakebite Patients, Progress in Venom and Toxin Research", Editors P. Gopalkrishnakone, CK. Tan, 1987:146.
21. Ray K. Bhattacharya, RK. *Journal of Indian Medical Association*, (1)1955:509-512.
22. Reide H.A. 'Myoglobinuria and seasnakebite poisoning, British Medical Journal, 1(1284), 1961
23. Russel FE. "The biochemistry and pharmacology of snake venoms, toxins of animal and plant origin", vo1.2, Gordon and Breach scientific publishers, London, 1973 ,p-1 00 1-1 0 11.
24. Sharma, BR. "Forensic Science in Criminal Investigation and Trials", 4th Edition, Universal Law Publishing Company, Delhi-33, 2007:776-777.
25. Sitaprija, Visith et al. "Renal Pathogenesis of snakebites, Progress in venom and toxin Research", editors p. gopalkrishnakone, ck. Tan, 1987: 105.
26. Subramanian, BV. "Modi's Textbook of Medical Jurisprudence and Toxicology", 1st Edition, Modern publishers, Gulab Bhawan, 6, Bahadurshah-zafar Marg, New Delhi, 2004, 196-200 .
27. Tewari SN. "Text Book of Medical Jurisprudence and Toxicology", CBS Publishers, Bombay, 1995: 812.
28. Triwithie ER. 'Detection of Snake Venom In Tissues' *Clinical Toxicology*, 1977; (10):141-145.

Snake Bite Poisoning - A Forensic Review

29. Triwithie ER. "Immunological diagnosis of snakebite, Toxins of animal and plant origin", vo1.3, Gorden and Breach scientific publishers, London, 1973, p-993.
30. Vick, JA; "Effect of acute snakebite and venom injection on vital physiological function, Toxins of animal and plant origin", vo1.3, Gorden and Breach scientific publishers, London, 1973, p-1 00 1-1 011.
31. Bryan Ballantyne, Timothy Marrs, Tore Syversen. General and applied and toxicology. 1st Edn, Macmillan reference Ltd, London, 2000; p 2180-2181.
32. *WHO guidelines for the clinical management of snake bites in Southeast Asia Region, 2005.*



Evidence through Scientific AID

Dr. Sahib Singh Chandna*

Introduction

A keen observation is of prime importance in the detection of crime. In Haryana, services of the scene of crime van had been made available round the clock to overcome the difficulties involved in safeguarding circumstantial evidences. Scene of Crime team assists the Investigating Officer to sort out the physical clues with regards to collection of qualitative and quantitative samples to be examined in Forensic Science Laboratory. At the crime scene even minute physical clue should be meticulously observed and nothing should be avoided. The team renders full assistance in visualization of dirt, hair, microscopic debris, fibre, paint, vegetable matter and even traces of blood. Collection of clues and making their availability to be produced in the Court in proper form envisages several stages:

- ❑ Screening and collection of physical clues.
- ❑ Marking and labeling of clues
- ❑ Selection of desired samples for fruitful results
- ❑ Packing and sealing of samples
- ❑ Transportation of evidence material to the laboratory
- ❑ Analysis of physical clues in the laboratory for authentic examination report
- ❑ Sustenance of clues during the course of trial
- ❑ Transportation of clues in the Court
- ❑ Presentation and formulation of clues in the Court.

Each stage mentioned above is equally important and envisages careful devotion. Even a small slip on any part of the investigating agency could weaken the case. It is not fair to say that some clues have

important evidential value until and unless the same is analyzed but scene of crime team could collect the clues in a more judicious manner as evident in the cited cases.

Expert Evidence

The scene of Crime Expert has to visit several Courts in connection with recording his expert evidence. He strives his best to prove the relationship of physical clues at the scene of crime with a particular incident of team's finding at the scene of crime.

The physical clues collected at the scene of crime have to be packed in a systematic manner. Good packing is beset with good and miraculous achievements. It is very astonishing, rather surprising that in the past some novice Investigating Officers used to wrap cotton around epidermal ridge characteristics in case of finger prints found available on glass-wares as a precautionary measure to avoid breakage. The finger-prints were, thus, in the process of destruction due to constant friction. The expert at the crime scene assists and guides in fabrication of wood cabins of suitable dimensions for packing of the physical clues for good return.

Most of the Investigating officers are ignorant of the medical terminology mentioned in post-mortem reports such as chyme, chyle, hemorrhage, pelvigriddle, medulla oblongata, etc. The expert tries to make them understand the terminology pertaining to a use of chemicals involved in a particular heinous crime. Post-mortem lividity in dependent parts of body involves superficial layers of skin and this fact gets established through the expert of the respective discipline.

Anticoagulants

Heparin: It is an ideal anticoagulant that inhibits the conversion of prothrombin into thrombin. It does not

Key Words

FSL (Forensic Science Laboratory), I.O. (Investigating Officer), Burglary, Suicide, Homicide, Murder, Crime investigation, Modus Operandi, Biology, Dowry death, Asphyxia

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Abstract

To begin, it is important to recognize that there are certain fundamental principles of crime investigation for which there are really no alternatives. Circumstantial evidences/physical-clues can be regarded as spokes on a wheel. If even one spoke is weak, the wheel will not run smoothly and the entire vehicle will be disrupted. In the similar way, entire system of crime investigation and

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cause any change in the composition of blood. It is not cheap, therefore, other coagulants are being preferred over Reparm now-a-days.

Potassium or Sodium oxalate

These compounds precipitate calcium, thereby inhibiting blood coagulation. These are highly soluble and therefore, preferred 5-10 mg of potassium oxalate per 5 ml of blood is being preferred. Potassium oxalate is also employed for collecting blood to estimate blood glucose.

Sodium Fluoride and Potassium oxalate

Sodium fluoride inhibits glycolysis and preserves blood glucose concentration. These are also employed for collection of blood for estimation of glucose.

Ammonium Oxalate & Potassium Oxalate

A mixture of these two compounds in the ratio of 2:2 is useful for collection of blood.

Ethylene Diaminetetracetic Acid (EDTA)

This chemical chelates with calcium and frequently used for collection of blood for hematological estimations.

According to belief in the past, it was believed that the children receive blood from 'the parents and it was union of-blood that was responsible for inheritance. Merely the terms 'blood relations', 'blood will tell', and 'blood is thicker than water' were being frequently used. These are still in vogue, despite the fact that blood as no more involved in inheritance with the advent of times more appropriate term and have replaced the past terminology.

- Gene relations in place of blood relations
- Genes will tell instead of blood will tell.

Implantation

But now-a-days implantation by some of the investigating agencies is a matter of common concern, thereby accusing innocent one or to add high returns for speedy turn out of the case by accusing and implanting blood on the weapon of offences. In a case, the Investigating Officer sent

blood stained exhibit (knife) in FSL, Haryana as a weapon of offence duly recovered by him. But expert, on the other hand, established the same as a case of implantation as no blood was found on the tip of sharp edge of the knife. When Benzidine tests were performed on the blade of the knife dotted with reddish brown spots, tests were found to be positive but application of benzidine tests on pointed tip as well as on sharp edged margin showed no result. From physical appearance of reddish brown spots as well as negative results on the tip and sharpened edge it became crystal clear that it was a bare and nude case of implantation.

The police officials are trained from time to time how to handle the scientific kits. The necessary training is also imparted as to how to lift the footprints even from the shallow water of pond or river.

The basic purpose of lifting of foot prints immersed in shallow water is that some culprits use to hide the stolen belongings in the village under dense bushes or rain puddle. But some of them also cross shallow water tributaries to reach the destination. Therefore, the Investigating Officer feels difficulty in lifting the foot prints from the slopes or various alignments or underneath water. The foot prints are lifted in the same manner but water is siphoned properly by placing a container around the foot print. But on the slope, frames of still more height are employed. Lower ends of these frames are automatically raised due to deposition of sand on its lower portion so that casting may be made easier, feasible and durable, thus, molds are prepared.

Case Studies

Scene of crime team has facilitated in providing scientific aid in investigations of a few cases. Some of them are enumerated as follows:

- A case u/s 279/304-A IPC was lodged as a suspicious accidental case. However, after serological examination of various blood stains on different types of tractors gathered for testing gave an another line and the Investigating Officer has to mould the case after seeking scientific aid from the expert, scene of



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crime van. The case had been found to be of murder due to detection of blood on one of the particular Tractor and blood stains on the accused. With the result, the section was changed. Physical examination of the physical clues such as broken glass of head light further corroborated the act of murder and it confirmed the involvement of HMT Zetor Tractor HYF 7451.

- In a case lodged, the Investigating Officer was unable to decide the site of occurrence of firing incident at some agricultural farms. By serological testing and observing the rays of blood coming towards the metalled road of the Equine Breeding Stud Farm, judgment of actual crime scene was furnished as a bund of field of barsim (*Trifolium alexandrium*).
- In another case, the Investigating Officer wanted to confirm whether it was a case of burning or accident. The report prepared by the Expert after observing physical clues had given an indication that it was not an accidental case but the kiosk was set ablaze.

Burnout Case

In a case, a housewife suffered burn injuries and succumbed to injuries in the Civil Hospital. It was also said that kerosene oil was sprinkled on her body and the deceased was set ablaze by igniting match stick. After severe burning, she was admitted to the hospital for treatment, but in vain. However, details of the case from the time of marriage onwards were as under:

Parents of the deceased were inhabitants of a village in Punjab. She was married in Haryana. Her parents spent about Rs. 70000/- on a demand made by her in-laws. Her in-laws had also borne the hire expenses of bus and cars and cooler was also given as gift at the time of marriage. Her brother and other relatives alleged that after about 2 years of her marriage, the in-laws of the ill fated victim started pressing her to bring more dowry of Rs. 20,000. The spouse of the deceased who was serving in military was expelled from the service and punished for 28 days imprisonment under some peculiar

circumstances. Therefore, the in-laws of the victim in pretence of illness left her in lurch and forced her to visit her parental home so that she should arrange for Rs. 20,000 for opening a shop, so that her husband could earn some livelihood. When the reality came into notice of her parents, they took this serious matter to a particular society. Meetings of the society were held thrice and they repeatedly demanded Rs. 20,000.

To see the deplorable condition of the victim, her parents were compelled to submit an application against her in-laws. The husband of the sufferer lady took her back to his home at the direction given by the Police. They used to beat her brutally every day. On one night, she was harassed, tortured mentally and beaten mercilessly. When she felt unconscious, kerosene oil was poured over her body and was set ablaze along with cushions. Then she was admitted at Civil Hospital, Sirsa where she succumbed to her burn injuries after four hours. Deceased also made a statement before the Magistrate regarding the whole incident. The Superintendent of Police also analyzed the case duly corroborated by the neighbours in the colony. Police arrested her mother-in-law under section 302 IPC and made enquiries through her husband and her father-in-law. Role of grandfather and grandmother of victim's husband was also found to be perpetuated. This case of dowry death remained the talk of town.

Superintendent of Police, Sirsa assured father of the deceased and her relatives that he would be leaving no stone unturned to deliver them justice. It is worth mentioning that the deceased's father and other relatives appeared before S.P. to narrate the incident.

Scene of Crime

In the drawing room, two mattresses were lying. These were covered with a light brown cloth of 'malasia'. The mattresses were stuffed with cotton. The mattresses were charred in the centre. Burnt clothes were also sticking to one of the mattresses giving a reflection that the deceased was sleeping on this particular mattress. Beside, on the mattresses some small damp gunny bag were lying and smell of kerosene oil was coming from these.

presentation of truthful physical evidences in the Court will collapse in absence of even a single significant clue when we fail to determine the principles underlying crime investigation. The level of stress under which the investigating agency has to work is coupled with periodic conventional evaluation proceeding with help from scientific personnel. Positive, optimistic and peaceful trend and coordination of investigating officers

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Near one mattress, the expert found a 5-litre 'servo' can containing some kerosene oil as indicated by the smell. Cotton of one mattress was lying in the form of a heap which was found to be partly burnt. Kerosene oil was found to be duly sprinkled in the drawing room at several places. It appeared that while pouring kerosene oil, the deceased was not overpowered and many persons in the house might have chased her. The pillows were lying on the side of each mattress. Their left ends were charred and reddish-blackish and whitish streaks were also found upon the mattress. Red printed cotton bed sheet was lying in burnt condition over one of the mattress.

Though the drawing room was equipped with plenty of ventilators, windows, almirahs and doors, yet smoke in the form of soot, due to burning, was found to be slightly but smoothly deposited on closed doors, windows, ventilators and almirahs. Smoke particles were also forming a thin fine layer just above the ventilators outside, reflecting that smoke escaped through the ventilators.

Upper lower bolt on the door opening inside the incident room of the house was loosely held. It might have been dislocated due to a sudden jerk. Two loosely arranged screws were found hanging on the upper portion of the bolt. Now question came in the mind of expert: Whether the deceased tried to loosen the bolt or the in-laws party had made a successful attempt in enacting the aforesaid picture of upper portion of the bolt. The screws embedded in the bolt were found to be pulled out with some implement. If the screws had fallen due to jerks, the lowest longer portion of the bolt would had been slightly loosened.

Though there were some impressions of finger crossings on the wall perpendicular to the door, yet the smokeless streaks only appeared after the process of ignition had been completed following accentuation. Otherwise, if the deceased had taken its support to reach up to the lower bolt, and due to her unsuccessful attempt the same could not have opened, then smoke must have been found to be deposited on the streaks.

As kerosene oil is an organic aliphatic long chain compound which burns emitting smoke, but not

volatile to such an extent as petrol. Therefore, the presence of liquid was detected in servo can and mattresses, gunny bags and floor.

Observation

In view of the above incident, observations of scene of crime gave reflection that deceased was very much right enough in furnishing her statement that the kerosene oil was poured over her body by some other family members as evident through the position and pulling out of screw's of bolt. They might have killed her by closing the doors from outside. Presence of kerosene oil on haphazardly placed items reflected that the deceased must have tried to flee and escape to save her skin but she was brought under control by her in-laws at the time of committing crime.

False Robbery Case

In a case of alleged foul play, some person submitted an application with the police station that the complainant was with his family in his house at village Malakpura. When he got a wink of sleep, kutcha and pucca bricks started falling down from the roof of the house. He also informed the local police in writing that some inimical persons had threatened to kill his family. He further added that the accused persons were armed with axes in their hands. He kept mum out of terror. The accused robbed golden ornaments and cash. The Investigation Officer was in a fix to know whether it was a case of robbery or not. He stressed upon the expert (author) to give him clear crystal guidance regarding robbery. He further added that if the incident was found to be true, he would be registering the case.

Observations

Following observations at the crime scene made the picture crystal clear that it was not a case of robbery :

- a. The joint wall of the staircase of the complainant and his neighbour was found to be severely damaged with the help of a spade. A huge heap of kutcha bricks and sand was lying upon the staircase.

in proper crime investigation. is based on the qua. zity of scientific aid, screening, orientation, collection and examination of well protected physical clues from the place of occurrence. It would be imperative to point out that state of mental-emotional patterns such as resentment, envy, fear and guilt can disrupt and disorder the process of investigation to a larger extent. Modern science is substantiating that every emotional touch



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- b. Half ft rectangular hole was drilled in the roof of the complainant. Its breadth was found to be comparatively less and was not in position even to allow the passage of accused but length of the hole was more proportionately.
- c. No accessory or any other item in the house was found to be disturbed.
- d. The Investigating Officer also explained that the complainant was caught red handed by the Police along with containers of illicit liquor a few days ago. To take revenge against the persons who had assisted the police, complainant had enacted the scene.

As the expert was sure enough that the observations mentioned above did not depict the case of robbery, therefore, he called D.S.P. personally. The officer got annoyed and furious over the false issue and ridiculed the complainant. Only the names of those persons were mentioned in the submitted complaint who assisted the police giving true information regarding transaction of illicit liquor. In this way, the people who assisted the police were saved from harassment. No case of robbery was registered at P.S. Sadar Dabwali after seeking advice from the expert Scene of Crime Van.

Fabricated Rape Case

In a case, a complainant lodged a complaint with the Police Station that she had been raped by unidentified persons, including a three-wheeler driver. She came to a site to see her relatives. She hired an autorickshaw to go to the place. But the auto-rickshaw driver along with other accomplices forcibly diverted the route towards the fields of another village. Her husband's voice was choked. Near the bank of Bhakra canal after crossing Railway Phatak, they turned the alleged autorickshaw towards the fields. They took her to a hut in the field where they raped her on the roof of the hut.

The husband of the complainant misled the expert while accompanying. Therefore, the expert of scene of crime team moved towards another side

of spot which was the actual place of occurrence. Therefore, expert told the SHO that he should depute other officials to go in separate groups to locate the actual site. However, scene of crime team was able to locate the actual place after wandering in the fields for four to five hours. This could be possible because the husband of the complainant had told the expert that another small hut is adjacent to the alleged hut. The team climbed up the roof of the said hut and observed the roof.

Investigation

It appeared that a 'khes' was apparently lying on the *Kutchra* roof. The accused might have used to make them comfortable for raping the victim. Small impressions of the said 'khes' on the muddy roof were clearly visible. Scene of crime expert was able to collect some blue and white threads of the 'khes'. Near the site of the alleged incident, some foot prints were observed clearly. Presence of impression of 'khes' gave indication that she was inter-coursed with her consent.

A search in the hut was made to find out some other relevant clues. The expert was able to collect 'khes' and one blanket only. The 'khes' was found to be blood stained. There were many type of 'hair' entangled in the 'khes'. All these hair were collected and these were handed over to the Investigating Officer. The threads picked from the site of incident were also given to the Investigating Officer.

The team performed "benzidine test" on the 'khes' stained with some reddish brownish material. The test turned out to be positive i.e. the presence of blood confirmed. But the blood present on the 'khes' had not clotted. It was explained to Sh. R.S. Dalal, the then worthy S.P. that the blood on the khes appeared to be "menstrual period". Officer replied in positive and these stains coincided with the actual place and time of intromissions. By switching on the ultra violet lamp upon the 'khes', it was proved that some semen was sticking to the khes as it showed fluorescence. Acid phosphatase test to detect the presence of semen also turned out to be positive.

is beset with innovative theory of investigation coupled with the help sought from forensic science personnel who exerts a beneficial influence in streamlining the modern line of investigation. It would be more wise to consult the professional scientists from Forensic Science Laboratory for an appropriate approach in crime investigation followed by screening, collection, transportation, storage

and examination of physical clues in an appropriate manner to present case reports in Courts for onward process of justice as Forensic science is the most important pillar of rustic, delivery system these days

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In the meantime, another interesting story came to light. The Investigating Officer told that the victim was booked for Rs. 125- as she had been involved in the act of prostitution for the last so many years. That is why struggle marks were not seen on the body of the said victim. She went deliberately with the clients. Her husband used to earn livelihood after striking the deal. Previously, similar complaint had been lodged at P.S. City Hansi. Previously in a case, the complainant during the evidence, denied before the Court that she had been raped and it was understood that she took Rs. 9000 as a tip to save the defendants. In the question under investigation, she was paid Rs. 30 instead of Rs. 125 as promised by her clients. Since she was not given the promised amount, she had lodged a complaint.

Keeping in view the facts and circumstances, scene of crime expert was of the opinion that the lady was involved in the flesh trade. Before proceeding further, it was very essential to verify her character and antecedents. Her husband was thoroughly investigated. Further, the persons who assaulted the above lady and raped her with connivance should be punished severely as per the law of the land.

Fire Case

In a case, the complainant lodged a complaint at P.S. Barwala that he purchased a four-wheeler No. HRX 7767 amounting to Rs. 95,000 in past decade and appointed a driver to drive the four-wheeler. One day, the four wheeler loaded with bamboos, was going to its destination, it was found to be out of order near water works of some village. The mechanic and the driver tried hard to repair the four wheeler till late hours upto night. Ultimately all of them went to their houses at 2.15 a.m. for rest. Some labourers working at water works gave the ominous news and alleged before the driver, that his four-wheeler had been burning.

Accompanied by Additional S.P., the crime scene team inspected the site with meticulous care and gave following reflections:

- * A burnt four-wheeler found to be parked in front of water works on one side of the road.

- * All the paraphernalia except metallic belongings were found to be burnt.
- * All the glasses were found to be broken due to emission of extensive heat.
- * Some cables were found to be partly burnt in front part of the engine of the four-wheeler.
- * The lid of the oil storage was found to be in its original position.
- * Towards the rear end of the four-wheeler plenty of material in the form of coal and ash was found available.
- * The crime scene was found to be littered with the pieces of burnt bidis.

The fire started from within the front end of the four-wheeler and gradually accelerated to rear-end.

At the crime scene, a large number of pieces of burnt '*bidis*' were found available. On interrogation, the driver replied that the mechanic and some persons who were called for pushing the four-wheeler had smoked. All of them were addicted to smoking. It took a plenty of time to repair the four-wheeler and lubricants were found to be smeared. He also stated that some straw was set on fire to locate repairing tools. The battery of the four-wheeler which also got burnt and reduced to pieces, rendered a futile attempt for mechanical inspection.

After discussion with the staff, expert scene of crime van derived the conclusion that either:

- a) There was sparking in the intertwined wires of the battery which led to the fire incident, or
- b) The mechanic and driver had left only rags rinsed with oil near the driver seat. The burning *bidi* was lying in its vicinity and the rags might have caught fire accidentally.

Murder Case

In a case, a desperate accused murdered his wife with the help of a spade by incising her head while she was sitting on the cot. The parents of the bride belonged to Rajasthan. The reason about the murder



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was cited as "The bride was disobedient 'and disloyal to her husband."

Though the murder was a nominated one, yet the Investigating Officer felt necessity to get acquainted himself with the clothes the accused was wearing while committing heinous crime.

The deceased was lying on the cot. Her head was severely injured and the incision was about 12 cm in length and about 4 cm deep. Hair on the head, face, eyebrows, nostrils, pinnae of the ears were stained and smeared with deep clotted blood. The cot and the clothes of the victim were also stained with blood. Clotted blood was observed underneath the cot and the height of the gushed blood in the form of a fountain was observed on the wall, floor and some articles, etc. Blood stained impressions in the form of finger prints were also found on the wooden part of a spade which was lying near a bush. Cut hair without roots, weapon of offence and clothes were also seen. Blood stained earth was sent for examination and the accused had been convicted in the Court during session trial.

Observation

Employing scientific method in crime investigation can reduce the burden of the Investigating agencies. If the physical clues are not recorded in proper time, these are likely to be destroyed such as blood can be washed by torrential rains, foot prints can be destroyed by trespassing of termites, rodents, creeping animals, etc., and blowing winds. Small fibres can be blown. Moreover, a number of visiting persons at the crime scene should be minimized, as every visitor can leave his clues also and according to theory of Edmund Locard, there is some gain or loss (mutual exchange) when two objects living or non-living come into contact with each other.

Therefore, crime scene should be well preserved and cordoned with a rope, and no person should be allowed to invade until and unless crime scene expert makes his first visit.

Methodology Pertaining to Drowning Cases

There are two main steps involved in the detection of diatoms in drowning cases:

- * Collection of samples
- * Extraction of samples

Collection of Samples

There are three important considerations for the collection of samples for forensic diatom analysis:

- I) Collection of samples of the putative drowning medium from the place of occurrence from where body has been recovered.
- II) Collection of biological samples during post-mortem examination/biopsy.
- III) Streamlining and maintaining appropriate chain for preservation of samples for submission in the laboratory.

Samples from the putative drowning medium should be obtained from the scene of recovery of corpse immediately after its recovery. Water samples must be placed in neat and clean container sealed with appropriate evidentiary tags and labelled with the deceased's name, location of sampling site, in addition to date, time and name of the particular individual sampling from water. Approximately 500 ml to 1000 ml of water has to be collected in a typical case.

Two types of samples are to be taken during the post-mortem examination which can be useful as base material for the diatom test in drowning cases.

- I) Tissues from which potential drowning associated diatoms can be chemically extracted.
- II) Samples of fluids from the body that serve as representative of the putative drowning medium.

Although different kinds of tissues have been advocated for the diatom test for drowning, the most useful for general application to all putative drowning deaths is the "Femoral Bone Marrow" because femoral bone has a spacious marrow cavity which

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is being protected from decomposition and post mortem examination by extraneous diatoms that are present on the external surface of the body. In addition, in the highly putrefied decomposed body when the parenchymal organs have putrefied, the femour will be available as a source for diatoms. The main reason to prefer the femoral bone marrow as preliminary material for the diatom test is the extensive scientific investigation that has validated the use of the femoral bone marrow as a site for extraction of diatoms from post-mortem tissues. Diatoms were also detected in marrows of sternum or clavicle of the drowned persons. The samples recovered can be more advantageous to use in comparison to the marrow of long bones and easy to remove from the body following time taken for acid digestion, sternum was comparatively less. So, generally clavicle and sternum were sent by police and doctor in the FSL for diatom test for confirming the cause of death by drowning.

Diatoms from samples of fluids recovered from the body could be indicative of the diatom content of the drowning medium.

It is important that all samples from the scene and the post-mortem examination have been appropriately retrieved and labelled. If the samples are to be analyzed in a referral laboratory, the sequence must be streamlined to show continuity of the physical evidence.

Prior to processing of the water samples from the scene, the water can be stored at 4 degree centigrade (standard refrigerator temperature) for several days to inhibit extensive growth of microorganisms. Alternatively, a diatom free formalin solution can be added to the water (1 ml 2% formal in to 500 ml of water) to inhibit microbe growth indefinitely and then the sample be stored at room temperature.

Extraction of Samples

There are two types of samples:

- I) Biological samples
- II) Water samples

The extraction of diatom frustules from samples of water, fluids and femoral bone marrow is made possible through chemical or enzymatic digestion and centrifugation. Although several extractive methods have been reported, but acid digestion method is the best method for the extraction of biological samples because nitric acid has been adjudged as the best tissue solubilizing agent, particularly for femoral bone marrow, or sternum, clavicle, etc., since the bone marrow contains trabecular bone. A major concern in the extraction process is the elimination of possible contamination of the evidentiary samples with exogenous diatoms or cross-contamination of the samples with diatoms from other samples.

Extraction of Bone Marrow

Forceps is used for the removal of bone marrow. In the laboratory, biological samples are placed into glass tare and washed in distilled water and then placed into the beakers. Then 400 ml distilled water and 50 ml nitric are added and kept on the gas for digestion, the bone gets completely dissolved in water. After digestion, the same is covered with aluminum foil and left overnight for settlement of the sediments. Next day, sediments are taken from the bottom with the help of dropper and the tarson tube is put into and centrifuged at 1500 rpm for 5-7 minutes and then the supernatant is discarded. This process has to be repeated for 3 to 4 times. Lastly, the pellet of viscera is washed and centrifuged with distilled water for removal of nitric acid. Then slides are prepared and diatoms are observed microscopically.



Forensic Odontology and Human Identity

Dr. J. R. Gaur*

Introduction

As per views of Kannappan, J.G. (1989) the then Principal Dental College, Madras and Vice President, Forensic Science Society of India. "Forensic Odontology has already evolved to be a precise and meticulous subject in the developed countries. Having known the reliability of the science, the evidence system have realized a requirement for expertise in many special forensic areas and particularly in forensic dentistry. Forensic Odontologists have improved their specific skills and have extensive knowledge in the branch of dental sciences. The exposure to the current principles and techniques involved in this aspect for the creation of stable and viable evidences with reference to photography, documents and dental models have expanded utility in the science.

The earlier feeling was that the general practicing dentist has insufficient training and experiences to assist effectively in identification or to provide expert testimony. Probably, this statement may not hold good in the present days. Presently, qualified dentists largely have great interest in the subject and also in the training programmes.

Keeping this point in view, Forensic Science Society of India, Madras evinced very great interest to organize a week long national workshop of Forensic Odontology at Madras in India during August 1985, when delegates from all over India participated. These delegates were even given exercises in the disaster victim identification training programmes.

World renown expert Prof. K.A. Brown from Australia led a five members team from Australia and Japan to go over Madras to teach and train Indian delegates, who hailed from all over the India.

The Forensic Science Society of India also utilized the Indian experts to deliver their expertise knowledge of forensic odontology to the delegates. The aims of the workshop were to formulate a plan to:

- a) Promote an awareness of the importance of forensic odontology as a service to the community.
- b) Support and encourage local experts in the pursuit of excellence in the practice of forensic odontology and thereby gain recognition of this discipline in the eyes of the public and administrative authorities.
- c) Promote mutual confidence and understanding between law enforcement agencies, legal authorities and forensic odontologists.
- d) Demonstrate the importance of close liaison and team work between forensic odontologists, forensic pathologists and investigating police.
- e) Provide both theoretical and practical instructions for the course participants in methods and techniques used in forensic odontology such as mass disaster victim identification, Forensic Photography as applied to forensic odontology, the determination of age by teeth, the investigation of bite marks and lip prints and legal implications of dental traumatology.
- f) Encourage the introduction of a specific course of forensic odontology in the curricula of dental schools or colleges of India.

With this congress, Indian delegations have been exposed to the entirety of Forensic Odontology knowledge and they are keen to serve as forensic

Key Words

Forensic Science,
Forensic odontology,
Fingerprints,
Identity,
Crime investigation,
Justice.

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Abstract

Forensic Science is as old as human civilizations. Evidences regarding the use of finger, palm and sole prints as seals are depicted in some of the pre-historic cave paintings all over the world, indicating that even in those times man had the knowledge that by using these evidences he could keep separate the paintings made by him from others. In China and Assyria respectively in 3rd and

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odontologists also, if given a chance to serve Indian courts and forensic department.

But unfortunately, there has been no positive response from the Judiciary to call for dental evidences from dental experts in India.

Even now, these evidences are accepted from the forensic medicine people only. It is desirable that the forensic trained dental persons should also be given chance in this regard, so that sufficient exposure would begin, resulting into perfection.

Thus, along with the enthusiasm of the young dentists coupled with the systematic educational procedures can make this science to prove its worth in India and also serve the Indian Society for the crime detection and mass disaster victim identification.

How exactly the forensic odontology can be specialized subject apart than forensic medicine is described below:

Forensic Odontology and Forensic Medicine

- Among the parts of the body, teeth are the last and the least to be destroyed in the adverse circumstances, including incineration. Teeth are highly calcified structure, resists putrifaction and burning. The nature of the teeth differs from the species to species. Hence, the knowledge of the teeth in various animals is a necessity for odontologist. To quote an incidence, a squab diver missed coming out the shore. The jackets which was found on the bed of the sea showed the evidence of having been mauled by shark's teeth.
- There had been incidences of bite marks on the human body by the dogs, cats, and rats which needed differential identification. The bite marks may be autogenous and different. This needs to be identified to pin point the accuracy by means of mensuration, photography and models. Failure to do these documents of the evidences, may result in the failure and loss of evidences and get lost in time, due to the healing power of the human body.
- The present day colour photography evidently shows the colour contrast of the tissues on the physiological and pathological basis. The redness, eccymosis, the depth of the lesions are clearly seen in the colour photography. The contrast photography for the dental structures made up of plastic or porcelain restorations is possible with U-V light and infra-red photography. These light photography have proved to be of good value in the autopsy specimens to detect the artificial restorations.
- The near and distant halographic and photographic evidences are comparable with the case of doubtful personalities.
- The orthodontic and dental records have proved of great value and worth in the disaster victim identification. In many airline crashes, where bodies were recovered, their identification by dental evidences had shown greater importance for authentic identification.
- The age detection is a complicated procedure. There are many ages in a man, the skeletal age, height age, weight age, size age, shape age, etc. The carpal index has to be tallied with chronological age concurrently. Dental development also confirms to a great extent to the normal variation in the chronological age. The number of studies have proved the worth of this age assessment with reference to other ages and needed attention. A very meticulous orientation of the various ages should be synchronized with reference to chronological age.
- The dental age has to be assessed with reference to the calcification of the crown and roots, the eruption dates of teeth, attrition and exfoliation. While the comparisons can be precisely taken, dental ages can be predicted to near accurate calculation.
- The nationality of the criminals can be ascertained by the nature of dental restorations by and large on the teeth. Almost all the developed countries produce the dental restorative materials under their own patency



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products. The chemicals and minerals assessment can give a clue for the country's origin.

Thus, the present day odontological findings are far more improved and that a dentist is the best expert in this line than any other experts.

Scope of Forensic Odontology

The scope of forensic odontology is as varied as the cases and problems presented. This field is demanding, challenging and intriguing. It requires dedication, a broad background of knowledge in dentistry, imagination tempered by common sense and a willingness to learn, often by independent effort. However, the forensic odontologist is rewarded with satisfaction and intelligent growth as he is in contact with a wide variety of other expert jurists and professionals. Thus, in the communication with other experts and development of manual techniques required for this discipline, and developmental attitude and values reflecting a sensitivity to the humanitarian aspects of this field the forensic odontology serves well.

Thus, with such wide expanse of knowledge of the subject of forensic odontology, our country should embark immediately for concerned specialist for accurate evidences in the courts. There are dental experts and have adequate knowledge in this field and can deliver a better deal than other. Earlier, use of these specialists helped the field of forensic odontology grow in India too, and this service would be in the exact dimension to the needs of the Indian courts.

Fossilized skeletons and teeth have always been the subject of study for the Palaeontologists and Palaeoanthropologists for exploring the channels of evolution of animal kingdom and ultimately, men, the "Homo sapiens". They have been successful in tracing the evolutionary history of various animal groups. Millions years old fossilized bones and teeth are traceable from the Sivalik Hills of Northern India and from numerous other fossiliferous beds of the country and the world. They speak of the type of fauna and the Palaeoecology of the particular area at that time. Similarly, Archaeologists and Historians

study bones and teeth recovered from their sites to know about the ancient civilizations and the historic periods. These bones and teeth are thousands of years old. Thus, it is quite apparent that bones and teeth are the hardest parts of the animal and human body and can survive decay for a very long time. Teeth being still harder than bones due to the presence of dentine can thus resist more to the chemical, heat and mechanical pressures. These are, thus, a valuable physical clue material in Forensic investigations. The study of dentition or teeth gives vital clues about the dental age of the persons. Since, the morphological and anatomical characteristics of teeth are controlled by genetical as well as environmental setup, so, the shape and size and the alignment of teeth in jaws is unique for a person. This permits individualization of one's dentition and their bite marks. What did the teeth reveal in the two crime cases is an interesting story

Case-I

One day a woman aged about 35 years went to the fields for fetching grass for her cattle at about 3.00 p.m. She did not return to her house at night. Her relations searched her in the fields during night but in vain. Next morning, at about 8.30 a.m. her bloodstained deadbody was noticed in a sugarcane field. Several bite marks of human teeth were present on her face, breasts and the arms. The trousers and the underwear of the victim were not in position. The shirt and brassier were found torn in the front upper middle region. Shoe prints of two types with characteristic sole pattern were found near the deadbody. Forensic examinations of the shoes and the dental plaster casts of ten suspects and their comparison with the bite marks present on the dead body and the shoe-prints lifted from near the dead body could connect the two suspects with the crime. Both the suspects admitted their guilt on interrogation by the police. The other eight suspects were set free after their shoe-prints and biting pattern of teeth were found different.

Case-II

One highly putrefied dead body of a young female was recovered from a river bank. One passport was found in the shirt pocket of the victim indicating that

7th century B.C. people used fingerprints so as to keep separate identity of their articles. The various branches of forensic science gradually developed in the world upto 19th century and it was in the year 1897 that the first fingerprint bureau of the world was established in Kolkata after Sir Edward Henry, Hem Chandra Bose and Khan Bahadur wrote a book on the classification of fingerprints. Subsequently, the

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she was a foreign national. Inquiries made from the concerned Embassy revealed that the person with same name had come about two weeks earlier to India on tourist visa. For establishing the identity of the person, the autopsy surgeon summoned the dental records of the person from her dentist with the help of her parents. It was interesting to note at autopsy that the person had got her upper incisors wired and nailed. The same could be confirmed from the dental records of the person summoned and thus the identity could be established on the basis of teeth.

From these two cases, It is quite clear that Forensic investigations from teeth do help in crime investigation and teeth give very useful information. Not only this, we come across so many cases in which the problem of the establishing identity of the victims has to be done on the basis of dentition of the individual. There are other cases in which bite marks are of utmost importance. A few examples are given in the succeeding paragraphs.

Skeletalized Bodies

In the cases of natural as well as unnatural deaths in which dead bodies are found from running or stagnant water, the soft tissues like skin and flesh get putrefied and detached from the body, leaving behind a partial or complete skeleton. Sometimes, in water the soft tissues are eaten up by marine animals and only skeletons are found.

In some other cases, when the dead bodies continue lying in thick forests or crops like maize and sugarcane etc. the birds and jackals or other carnivores eat up the flesh and the remnants available are only bones with traces of flesh. Further, after putrefaction the soft tissues of cadavers are also eaten up by maggots. The identity of the victims in most of such cases when no body wearings or garments are available has to be established on the basis of bones and teeth.

Aeroplane Crashes

In 20th century, there has been continuous increase in the number of plane crashes with the persistent increase in air traffic. We have faced unfortunate occasions when there were mass casualties in such

accidents and the human bodies were burnt and charred to the extent that they could not be recognised. Dentition or teeth of the victims played a vital role in the identification of such bodies. The air traffic is bound to increase in the 21st century, hence, the possibility of more such incidents cannot be ruled out.

Explosions

The terrorist attacks in this country and outside have made us face tragic situations of mass killings in explosions. The explosive effect is so forceful that the body parts are flown away to very far off places and due to heat and flames the body tissues get burnt, thus rendering the common man helpless for identifying the victims. We may talk of any explosions inside buses, trains and .crowds at bus stands or railway stations, etc. the problem of identity of the victim has to be solved. Teeth again give important clues in such cases for identity.

Burn Cases

It can be very useful in accidental or intentional fires in large buildings, where human burnt bones and teeth are found, or the dowry death cases in which the victims are cremated for concealing the crime or rioting situations in which live persons are burnt to death. The burnt teeth/dentition and dentures can provide concluding clues about the identity of the person.

Sexual Offences

In such cases, bite marks of human teeth are sometimes found on the person of the victims as well as on the accused(s). As the alignment of teeth in each individual is different so the bite marks of the perpetrators can be identified from the study of comparison of their teeth or dental casts

Animal Bites

In some homicide cases, it has been observed that the miscreants inject poisons to the victims with the help of injections, and two punctures are made so as to make look like a snakes bite, in which two fang bite marks are usually seen. In such cases, snake bites on the skin can be identified with the

oldest handwriting

bureau in India was established as GEQD, Shimla in the year 1904. 20th century has been the age of science as there have been tremendous scientific developments in the world. Enormous development of forensic science institutions took place in the world in the 20th century itself, and at present we have about 34 forensic science laboratories in India, 28 fingerprint bureaux and more than 120



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help of fang impressions of the snake and other teeth which are also seen on the skin. In certain other cases in which animals bite human beings. e.g., a dog or cat bite, monkey bites etc., the bites sometimes have to be identified for the purpose of treatment. The same can be done on the basis of comparison of bite marks with animal dentition.

Age from Teeth

How the age is determined from teeth or dentition and what factors help in establishing identity from human teeth are also the subjects of interest. The salient features are:

We all know that at birth the child has no teeth. Normally, it is the pair of central lower deciduous incisors which erupts first at the age of about 6 to 8 months in infants. Rest of the deciduous teeth or milk teeth follow the course of eruption at specific times and all these temporary or deciduous teeth erupt upto the age of 30 months in children. The total number of deciduous teeth is twenty as the

temporary dentition does not have premolars and third molars or wisdom teeth.

At the age of about six years, the pair of central lower deciduous incisors is replaced by permanent set of incisors and then turn by turn the deciduous teeth are replaced by permanent teeth at different intervals of time upto the age of 14 years, that is, when the second molar permanent teeth erupt. The last permanent teeth to erupt are third molars which erupt between the age of 17 to 25 years in 80% of the human population. However, the permanent third molar teeth may remain unerupted in about 20% of the persons for their whole life. It may be mentioned that the eruption of deciduous and permanent teeth is governed by the nutritional status of the populations and, thus, there are slight variations in the eruption of teeth of various human populations. However, numerous scientific studies on the eruption of teeth have been carried out throughout the world and the data for most of the populations are available in the literature for the estimation of age from teeth or dental age.

Table-I Mean Ages of Emergence of Permanent Teeth

Maxillary	Mandibular	Age (Years)	
		Boys	Girls
	M ₁	6.17	5.62
M ₁		6.61	6.03
	I ₁	6.61	6.46
I ₁		7.08	6.92
	I ₂	7.59	7.59
I ₂		8.13	8.13
P ₁		10.47	10.47*
	C	10.71	9.77*
C		10.97	10.23
	P ₁	10.97	10.47
P ₂		11.48	11.22*
	M ₂	11.48	10.72*
	P ₂	11.75	11.22
M ₂		12.02	11.22

* The sequence is reversed in girls for (i) lower canine and upper P1 and (ii) lower M2 and upper P2.

departments of forensic medicine in various medical colleges in the country. At present more than 3500 forensic science laboratories stand established in the world. The science of forensic odontology also developed in the 20th century all over the world, but, in India, it progressed only in the last two decades of the 20th century and is progressing leaps and bounds in the 21st century with the establishment of more dental colleges in the

Government and private sector.

The importance of forensic odontology in crime investigation and administration of justice is highlighted in the present paper with examples of a few important cases. What important parameters we should consider in forensic odontology for establishing identity are discussed in this presentation.

Table-II Age levels for specified numbers of permanent teeth present

No. of permanent Teeth present	Age (Years)	
	Boys	Girls
2	6.17	5.62
4	6.61	6.03
6	6.61	6.46
8	7.08	6.92
10	7.59	7.59
12	8.13	8.13
14	10.47	9.77
16	10.71	10.47
18	10.97	10.47
20	10.97	10.47
22	11.48	10.72
24	11.48	11.22
26	11.75	11.22
28	12.02	11.22

Table I & II After Kaul, S. (1976)

For further details regarding age determination of teeth the readers are referred to the studies Kaul et.al. (1975), Kaul and Parkash (1984), Hongwei et.al. (1991) and Ansari et.al. (2005).

After eruption, the teeth are always in use and it is the degree of wear or attrition of teeth which indicates about the age of the person.

Identity from Teeth

Identity of the person from the teeth can be established on the basis of:

Arrangement of Teeth

Usually, the arrangement of teeth in human beings is Incisors, Canine, Premolars and Molars. But, sometimes, some teeth may remain undeveloped in the dental arch and leave a gap known as diastema. Moreover, some extra teeth may remain in the dental arch when the eruption of the permanent teeth is palatal, lingual or labial, i.e. outside the dental arch. These teeth are known as additional teeth. They sometimes do not have usual shape and hence, are known as malshaped. All

these peculiarities in one's dentition help in the identification of the person.

Malocclusions

Due to improper placements of the upper and lower teeth, sometimes the teeth may be found to have more attrition on the labial or lingual surface. The person can be identified from such peculiar occlusion habits.

Teeth Pigmentation

Due to the presence of excessive salts in drinking water or the disease of the teeth and gums, the teeth may be bluish, chalky or reddish in colour. Such pigmentations of teeth again help in identification.

Restoration Marks

Due to caries, the teeth break or cavities are formed in them. For retaining such teeth gold and silver permanent fillings or caps are applied to the teeth, which sometimes are found intact even after burning. Such restoration and their records with the dentist help one in identifying the person.



Forensic Odontology and Human Identity

Surgical Artifacts

In accident cases, mandibular and maxillary fractures are very common. In small children mandibular fractures are caused due to fall on the hard floor. For keeping the teeth and the dental archs in position, wiring and nailing, etc. has to be done surgically. Such surgical artifacts are left as such sometimes inside the body from which a person can be identified.

Dentures

Dentures, partial or complete are prepared uniquely for a person so that these properly fit within his other teeth and in the dental arches. Thus, size, material and shapes of dentures also help in identification.

Habits or Occupational Marks

Persistent pipe smokers are found to have notched incisors. Similarly bag pipe players hold the metallic end of the pipe in their teeth, cobblers and carpenters hold nails, etc. in their teeth and thus can be found to have notched teeth and hence, a peculiarly in their dentition.

Tooth Fractures

The breakage of tooth accidentally and the repairative processes which occur again, leave the tooth with a peculiarly which is also an identifying mark for a person.

Hence, Forensic examination of teeth is of utmost help in crime investigation for the determination of age and establishing identity. There is no doubt that

these days DNA Fingerprinting has made identity nearly 100% possible, but when DNA Fingerprinting cannot be carried out due to lack of facilities or the appropriate tissue materials, teeth are of paramount importance in such cases.

References

1. Ansari, S.M.A., Kumar, K.S.P. and Janjua, P.K. (2005), "Identification from Bite Marks a Preliminary Study, in: An Interdisciplinary approach to Forensic Science", Selective and Scientific Books Publishers and Distributors, New Delhi, pp.28-33.
2. Hongwei, Song, Jingtao, Jia and Cameron, J.M. (1991), *Med. Sci. Law*, Vol. 31, No.1, pp. 65-68.
3. Kannapan, J.G. (1989) Proc Indo-Pacific Congress on Legal Medicine and Forensic Medicine and Forensic Sciences, Madras, India.
4. Kaul, S. (1976), 'Estimation of Age for the Emergence of Teeth', *Indian Pediatrics*, Vol. XIII, No.3, pp. 233-235.
5. Kaul, S. Saini, Sushma and Saxena, Bindu (1975), 'Emergence of permanent teeth in school children in Chandigarh, India, Archs'. *Oral Biol.* Vol 20, pp. 587-593. Pengamon Press, Greate Britain.
6. Kaul, V. and Parkash, S. (1984), 'Crown Dimensions of Deciduous and Permanent Teeth of Jats from Haryana (India)', *Anal. of Human Biology*, Vol. 11, No.4, pp. 351-354.

Key Words

Astray
Socialization
Process of Learning
Peer Group
Other Social Groups
Secondary Groups
School
Play Group

Astray Socialization of Children in Prisons

Dr. Deepti Shrivastava*

Introduction

Over a period of years, our entire social structure has undergone a sea change of morals and ideals. The changing social norms and values as well as the impact of other cultural patterns culminating in the complexity of life are largely responsible for this change. Criminality amongst women can be traced to rapid urbanization, industrialization, new socio-economic stresses and strains, break up of the age old institution of joint family, broken homes, conflicts and unhappy interfamilial relations, widening of spheres of occupational and social activities.

Even though women conviction rate is quite low in comparison to that of male in IPC crime. Refer figure 1 of female arrested under IPC and SLL crimes during last five years. In most societies, women have primary responsibility for the family, particularly when there are children involved.

When women are incarcerated, this greatly affects the standard of living of their children. Children

become displaced when their mother is taken away, and many emotional and physical needs are no longer met. Basic human rights that are endangered by the incarceration of mothers include the right to food, clothing and housing, the protection of the family unit and the right to pursue education.

Children whose mother have been arrested and incarcerated faced many kinds of difficulties. The imprisonment of a mother leads to a series of rapid changes in the lives of both mother as well as her children. This is certainly one of the worst aspects of imprisonment.

As we know the nation's children are an extremely significant asset. Their look after and concern for proper socialization are our accountability. Children's healthy socialization should find outstanding element in our countrywide strategy for the growth of human resources, so that our children nurture up to turn into full-bodied resident, bodily fit, psychologically alert and morally healthy, gifted with the talent and inspirations endowed with society. Equivalent prospects for progress to all children throughout the phase of development should be our aim, for this would serve our larger purpose of reducing dissimilarity and bring social justice. But unfortunately children accompanying women prisoners are going astray of it.

In the last decade, professional interest in children in prisons have significantly increased. A good number of studies have been undertaken on prisoners children. But in the present study, a focused attention has been made on astray socialization of accompanied children in prisons. Since no study has so far exclusively devoted on this area. The present study is anticipated to fill up the cleft of

Figure 1: Female Arrested Under IPC and SLL Crimes during Last Five Decades

Source : *Crime in India* 2006

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criminological literature and criminal justice administration.

Objectives

The objective of the present study is mainly to investigate the problem of accompanying children in Indian prisons. Present study covers following four areas:

- ▲ To identify the nature & extent of astray socialization of accompanying children of women prisoners.
- ▲ To identify the causal factors & instigators for improper socialization of children.
- ▲ Normative provisions for accompanying children of women prisoners.
- ▲ To suggest preventive measures for proper socialization of children in prisons.

Methodology

This study is based on both primary and secondary data. As already numerous studies are being conducted in relation to problem of children in prisons at international level but study of astray socialization of children in prison in Indian context are very few. In this research paper, a number of common issues and variables are focused upon. It seeks to investigate the nature, causes and consequences of the astray socialization from Indian prisons perspective. In this paper, researcher has also examined the nature and magnitude of the problem.

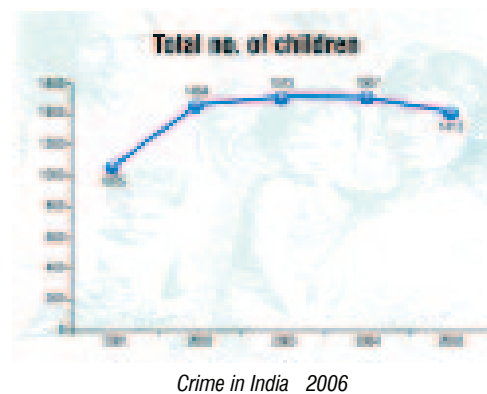
Children whose parents have been arrested and incarcerated face unique difficulties. Many have experienced the trauma of sudden separation from their sole caregiver, and children accompanying their incarcerated mother are most vulnerable to the feelings of fear, anxiety, anger, sadness, depression and guilt. And in addition to this problem of improper socialization, the behavioral consequences can be severe due to absent of positive intervention.

Generally, in most of the states and UTs, children are allowed to live with their mothers up to the age of 4 years or in special cases up to 6 years by the approval of the Superintendent. Model prison manual,

2001 too recommends that a child up to six years of age shall be admitted to prison with his mother if no other arrangements, for keeping him with relatives or otherwise, can be made.

There are approximately 1,413 children in India currently live in state prison, an estimate derived from the following statistics. Around 13,986 women are incarcerated in Indian prisons till end of 2005, of which 65 percent are undertrials and 25.3 percent are convict. About 8.9 percent of the women

Figure 2: Accompanying Children in prison



prisoners are mother with an average of 440 women prisoners having accompanying children as given in Figure no. 2

The study noted that "These children are recognized as a group of astray socialized children in prisons." The prison system does not regularly inquire at the time of admission or sentencing whether a women prisoner has children specially. One prominent researcher contends that "...these children have tended to be ignored by the criminal justice and social services systems..."

As 1,413 children were living in different prisons of the country with their prisoner mothers as on 30.12.05, the states wise distribution of astray socialization of accompanied children in prisons is as under:

Total 1,413 minor children are living in prison with their mother. These Children by and large were surviving under difficult circumstances, facing diverse scarcity relating to basic needs. There is a

Abstract

Children whose mothers have been arrested and incarcerated faced many kinds of difficulties. The imprisonment of a mother leads to a series of rapid changes in the lives of both mother as well as her children. This is certainly one of the worst aspects of imprisonment.

Astray Socialization of Children's in Prisons

Table : 1

States	Total
Andhra Pradesh	50
Assam	44
Bihar	125
Chhattisgarh	62
Gujarat	11
Haryana	47
Jharkhand	116
karnataka	196
Madhya Pradesh	96
Maharashtra	150
Orissa	25
Punjab	88
Rajasthan	45
Tamil Nadu	84
Uttar Pradesh	219
West Bengal	131
Total	1345

(Source: *Prison Statistics, 2005*)

strong need of suitable programmes which may be helpful for the bio-psycho-social development of children who were being looked after mostly by their mothers, as no trained staff was found in any prison to take care of these children. (Srivastava S. P., 2006)

Socialization

Socialization is the process by which the children acquire a cultural content, along with selfhood and personality. (Green, Arnold, Sociology, p. 127) By socialization point of view this is a very decisive face of Children. A child socialized with the help of different agents of socialization, which is not available in prisons affects the different stages of child development as given in Table 2.

The family is perhaps the most important source of socialization, given its central role in the early developmental period. It plays the central role because it introduces children to intimate

relationships and gives them their first experience of being treated as distinct individuals. In essence, the family is the child's first reference group, the first group whose norms and values the child adopts as his or her own and uses to evaluate his or her behavior. The family also introduces children to group life.

Several factors in family life affect socialization. For example, fathers and mothers have different parental styles. Fathers tend toward physical play and unfamiliar games, while mothers tend toward vocal interaction and familiar games. The number of siblings and the birth order also has substantial effects. Interactions with siblings enable children to learn about cooperation and conflict as well as negotiation and bargaining. Finally, the family introduces the child into society, helping him or her to find an identity in the larger social world.

But unfortunately accompanying children of women prisoners are going astray of this process. In most of the prisons, these children are not being provided even proper education during the play stage, children begin to pretend to be other people. Mother inmates generally have to share their depression and worries with their children.

Charles Horton Cooley (1864-1929) was one of the first theorists to consider the social origins of self. The self is the notion that each individual has a unique and distinct identity; it emerges from interactions with others. Cooley developed the idea of the looking-glass self: We acquire our sense of self by seeing ourselves reflected in other people's attitudes and behaviors toward us and by imagining what they think of us. The looking-glass self, then, is a mixture of observation, imagination, and subjective interpretation. Perhaps most important, it is a social construction. Cooley also distinguished primary relationships (family and close friends) from secondary relationships (casual acquaintances).

George Herbert Mead traced the development of self-awareness to early social interaction. He stressed the use of significant symbols, signs, gestures, and language used to interact with others.

As we know the nation's children are an extremely significant asset. Their look after and concern for proper socialization are our accountability. Children's healthy socialization should find outstanding element in our countrywide strategy for the growth of human resources, thus that our children nurture up to turn into full-bodied resident, bodily fit, psychologically alert and morally healthy, gifted with



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Table : 2 Possible Developmental Effects on Children of Parental Crime, Arrest, and Incarceration

Developmental Stage	Developmental Characteristics	Developmental Tasks	Influencing Factors	Effects
Infancy (0-2 years)	Total dependency	Attachment and trust	Parent-child separation	impair parent-child bonding
Early childhood (2-6 years)	Increased perception and mobility; incomplete individuation from parent	Sense of autonomy, independence and initiative	Parent-child separation; Trauma	Anxiety, developmental regression, acute traumatic stress, survivor guilt
Middle childhood (7-10 years)	Increased independence, ability to reason, importance of peers	Sense of industry, ability to work productively	Parent-child separation, enduring trauma	Acute traumatic stress and reactive behaviors
Early adolescence (11-14 Years)	Increasing abstract thinking, behavior, aggression, puberty	Ability to work productively with others, control of emotions	Parent-child separation, enduring trauma	Rejection of limits on behavior, trauma reactive behaviors
Late adolescence (15-18 years)	Emotional crisis and confusion, adult sexual development, abstract thinking, independence	Achieves identity, engages in adult work and relationships, resolves conflicts with family and society	Parent-child separation, enduring trauma	Premature termination of parent child relationship; intergenerational crime and incarceration

Through symbolic interaction, children learn to anticipate what others expect and to evaluate and adjust their own behavior accordingly. Mead believed that the self includes two parts: the "I" and the "me." The "I" is the active, spontaneous, idiosyncratic self, and is the product of individual distinctiveness. The "me" is the social self, a product of socialization. Together these two elements help to define an identity--the self.

It is difficult for father to maintain contact with their children and wife while they are incarcerated. More than half of incarcerated mothers do not receive any visits from their children while they are in prison. The single most significant reason for lack of contact is the children's distance from their mothers' prisons, many of which are located far from major population centers.

Causational Factors

On the basis of present study, the researcher has come to this conclusion that there are many Causational Factors responsible for astray socialization of accompanying children of women prisoners. Main causational factors are as under:

- Small number of women prisoner.
- Lack of sociologist psychologist.
- Inadequate educational Staff & Poor education Facilities.
- Poor Strength of Correctional / Welfare Officer.
- Lack of Speedy trail.
- Untrained staff.
- Lack of crèches & peer Group.
- Play ground is not available for small kids.

the talent and inspirations endowed with society. Equivalent prospects for progress to all children throughout the phase of development should be our aim, for this would serve our larger purpose of reducing dissimilarity and bringingsocial justice. By socialization point of view this is a very decisive face of Children. A child socialized with the help of different agents of socialization which is not available in prisons affects the child

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Accompanying children share the sufferings of their imprisoned mothers and remain deprived of these basic needs: Adequate parental care, recreation and early education. Living in prison impacts negatively upon the children's physical as well as mental development.

Normative Provisions

The Government of India is implementing various schemes and programmes for the benefit of the children. Further, a National Charter for Children, 2003 has been adopted to reiterate the commitment of the Government to the cause of the children, in order to see that no child remains hungry, illiterate or sick. In this Charter, the Government has affirmed that the best interests of children must be protected through combined action of the State, civil society and families and their obligation in fulfilling children's basic needs. National Charter has been announced with a view to securing for every child inherent right to enjoy happy childhood, to address the root causes that negate the health, growth and development of children, and to awake the conscience of the community in the wider societal context to protect children from all forms of abuse, by strengthening the society and the nation. The National Charter provides for survival, life and liberty of all children, promoting high standards of health and nutrition, availing basic needs and security, play and leisure, early childhood care for survival and growth and development. It also ensures protection from economic exploitation and all forms of abuse, protection of children in distress for the welfare; and providing opportunity for all round development of their personality, including expression of creativity, etc.

In addition to this, for the care, welfare and improvement of the children, special and specific provisions have been made both in Part III and IV of the Constitution of India, besides other necessities in these parts which are also considerable. The best interest of the child has been given as a most imperative deliberation in our Constitution. Article 15 proscribes discrimination on grounds of religion, race, caste, sex or place of birth. Article 15(3) provides that this shall not prevent the State from making any special provision for women and

children. Article 21A, inserted by 86th Constitutional Amendment, provides for free and compulsory education to all children of the age of six to fourteen years. Article 24 prohibits employment of children below the age of fourteen years in any factory or mine or engagement in other hazardous employment. The other provisions of Part III that are notable are Articles 14, 21 and 23. Article 14 provides that the State shall not deny to any person equality before the law or the equal protection of the laws within the territory of India. Article 21 provides that no person shall be deprived of his life or personal liberty, except according to procedure established by law.

The Juvenile Justice Act, 2000 replaced the Juvenile Justice Act, 1986 to comply with the provisions of the Convention on the Rights of the Child which has been acceded to by India in 1992.

However, on the basis of various affidavits submitted by various State Governments and Union Territories, as well as the Union of India, it becomes apparent that children of women prisoners who are living in prison require additional protection. In many respects, they suffer the consequences of neglect. While some States have taken certain positive measures to look after the interests of these children, but a lot more is required to be done in the States and Union Territories for looking after the interest of the children. It is in this light that it becomes necessary to issue directions so as to ensure that the minimum standards are met by all States and Union Territories vis-à-vis the children of women prisoners living in prison.

In response to a public interest litigation dealing with under trial prisoners, the Supreme Court carried out an in-depth examination of the issue and gave extensive directions with regard to the children of women prisoners, in a judgment delivered on April 13, 2006. The Court took note of various provisions in the Constitution as well as laws enacted for the benefit of children.

Preventive Measures for Proper Socialization

Prisons are demoralizing places even for grown up person; these are probably far worse for women

development. But unfortunately children accompanying women prisoners going astray of it. Present paper examines this problem and suggests some remedies.



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prisoners. Prison manuals that administrate the prisons do not include any special provisions for accompanying children of women prisoners who constitute a particularly vulnerable category. The women are in prison either as undertrials accused of an offence, or as convicts. Unlike other inmates, the children are in prison not for any delinquent behaviour but because their mothers are in prison. Either they are born in prison, or they are too young to stay away from their mothers, or there is no one to look after them in the absence of their mother. (Shukla Rakesh, 2006)

Successful socialization can result into uniformity within a society. If all children receive the same socialization, it is likely that they will share the same beliefs and expectations. This fact has been a strong motivation for correctional administration across the country to standardize socialization of accompanying children of women prisoners. Study suggests some Preventive Measures, with which help the existing prisons system can handle the astray socialization.

First, regular contact of other family members is very essential when children live with their mother in the prison system. Imprisonment will often break up family relationships and break down links with the community. Imprisonment have its negative impacts on accompanying children of incarcerated mothers, who are in prison have special needs for contact with their families for healthy socialization.

Secondly, a number of programs should be introduced for children to connect with peer groups in prisons. These programs commonly help to provide transportation for children to enable them to visit their secondary groups. Such edification tour provides life skills training akin to assimilation, adjustment and visitation for children of incarcerated mothers. These processes are essential for healthy socialization.

Thirdly, variety of counseling programs should be introduced to provide emotional assistance for

children of incarcerated mothers, most commonly taking the form of a support group. These support groups should be designed only for children, promoting emotional well being as well as proper socialization.

Fourthly, proper educational and recreational opportunities must be provided to children of women prisoners. A crèche and nursery in presence of highly trained psychologist should be attached to the prisons. Children should be put into a crèche and nursery.

Conclusion

Although several programs currently exist to help children of prisoners, the key, of course, is whether these programs actually improve the socialization of children to improve their life. Existing study does not make a definitive answer possible. Through additional research, it is hoped that a better picture will emerge so that policymakers, correctional administrators, and voluntary organizations can address the unique needs of children of prisoners effectively .

References:

Cynthia Seymour, 1996, 'Children with Parents in Prison: Child Welfare Policy, Program, and Practice Issues,' Child Welfare, Special Issue, *Children with Parents in Prison*, Child Welfare League of America, Vol. LXXVII, p. 472.

Dr. Denise Johnston, 'Effects of Parental Incarceration,' in *Gabel and Johnston*, p. 68.

Prison Statistics, 2005, Ministry of Home Affairs, New Delhi

R.D. Upadhyay vs. state of Andhra Pradesh, 2006 **Supreme Court of India**

Rakesh Shukla, 2006 InfoChange News & Features.

S. P. Srivastava , 2006 "Children Of Women Prisoners issues That Deserve Attention"

Key Words

Plea Bargaining
Mutual Disposition
Pre-trial Negotiation
Slow Motion Syndrom
Sentence Bargaining
Charge Bargaining

Plea Bargaining in India

Dr. Avimanyu Behera *

Introduction

The aim of Criminal Law is to protect the rights of individual and state against the international invasion by others, to protect the weak against the strong, the Law abiding against lawless and the peaceful against the violent. It is the solemn duty of the state to protect the life, liberty & property of the citizens. Cases like Best Bakery, Priyadarshini Matoo, Jesica Lal and Nitish Katara are reminiscent of the major loopholes in the Criminal Justice delivering mechanism which has a direct impact on the levels of lawlessness in our society. Plea-bargaining is an essential component of the administration of Criminal Justice. It leads to prompt and final disposition of most Criminal cases.

Plea Bargaining : Definition

There is no perfect or simple definition of plea-bargaining. Black's Law Dictionary¹, defines it as follow: " The process whereby the accused and the prosecutor in a Criminal Case work out a mutual satisfactory disposition of the case subject to Court approval. It usually involves the defendant's pleading guilty to a lesser offence or to only one or some of the Courts of a multy-count indication in return for a higher sentence than that possible for the graver charge."

A "plea bargaining" is a practice whereby the accused foregoes his right to plead not guilty and demand a full trial and instead uses a right to bargain for a benefit. This benefit is usually related to the charge or sentence. In other words, plea bargaining means the accuser's plea of guilty has been bargained for and some consideration has been

received for it². A plea bargain is derogation from the concept that a Judge can only decide a sentence after hearing in an open Court.

The term 'plea-bargaining' is used to cover different things. It is sometimes used to describe discussions between prosecution and an accuser's legal advisers concerning the charges upon which an accused will be presented for trial and including indications that the accused is prepared to plead guilty to certain offences. This may be described as prosecutorial plea bargaining. The term also covers discussion in which the trial judge takes part. In such an arrangement counsel for the accused and the prosecution attend the Judge in his private Chamber and discuss upon the Judge indicating the probable sentence of the accused, through this counsel, indicates that he will plead guilty. This may be described as Judicial Plea-bargaining.

Article III See 2 (3) of the U. S. Constitution proved that "The trial of all crimes except in cases of impeachment, shall be by Jury."

Background

In United States Vs. Jackson³, the Court questioned the validity of the plea bargaining process of it burdened a defendant right to a jury trial. The issue in that case was a statute that imposed the death penalty only after a jury trial. Accordingly, to avoid the death penalty, defendants were waiving trials and eagerly pleading guilty to lesser charges. Justice Potter Stewart, writing for the majority, noted that the problem with the statute was not that coerced guilty Plea but that it needlessly encouraged them.

¹ 8th Edition, 2004, page No. 1190

² Ferguson & Roberts : Plea bargaining Directions for Canadian Reforms (1974) 52 can Bar Re 497 at 501 Management of A Police Welfare Programme : "Arogya Bhadrata Scheme" In Andhra Pradesh-A Study

³ 390 US 570 (1968)

⁴ 397 US 742 (1970)

⁵ 404 US 257 (1971)

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Two years later, the Court actually defended plea-bargaining in *Brady Vs. United States*⁴. Pointing out that the process actually benefited both sides of the adversary system. The Court noted that its earlier opinion in *Jackson* merely required that guilty pleas be intelligent and voluntary. The following year in *Santobello Vs. New York*. The Court further justified the Constitutionality of Plea bargaining referring to it as, "an essential component of the administration of Justice". The Court added that as long as it is properly administered, plea-bargaining is to be encouraged⁶.

Indian Scenario

The Criminal justice delivery system of India has been mired by the perennial problem of delays. Given the kind of delays, which afflict the system, the pursuit of justice is often a painful tedious process that results in the unfortunate feeling that it is a sheer waste of time. Several Judges, Scholars & Media personalities have expressed serious concerns about the slothful, sluggish and slumbering State of justice delivering system Justice Krishna Iyer while dealing with a bail petition in "*Babu Singh Vs. State of Uttar Pradesh*"⁷ remarked:

"Our justice system even in grave cases, suffers from slow motion syndrome which is lethal to fair trial whatever the ultimate decision. Speedy Justice is a component of social Justice since the community, as a whole is concerned in the criminal being condignly and finally punished with a reasonable time and the innocent being absolved from the inordinate or deal of criminal proceedings".

In *Hussainara Khatoon & others Vs. Home Secretary, State of Bihar*⁸ with reference to the under trial persons the Supreme Court observed :

"No procedure which does not ensure a reasonable quick trial can be regarded as " reasonable, for or just and it would fall foul of Article-21. There can, therefore, be no doubt that speedy trial and by speedy trial was meant reasonable expeditious trial, is an integral and essential part of the fundamental

right to life and liberty enshrined in Article-21.

Despite judicial pronouncements, inordinate delay and expensive litigation are still haunting the justice delivery system. Due to prolonged and faulty investigation, lack of scientific and technical expertise on the part of the police department, accused acquires an upper-hand over the prosecution.

Charge & Sentence Bargaining

Plea bargaining refers to pre-trial negotiation between the defendant, usually conducted by the counsel and the prosecution, during which the defendant agrees to plead guilty in exchange for certain concessions by the prosecutor. "Plea-bargaining falls into two distinct categories depending upon the type of prosecutorial concession that is granted. The first category is "charge bargaining" which refers to a promise by the prosecutor to reduce or dismiss some of the charges brought against the defendant in exchange for a guilty plea.

The second category "Sentence bargaining" refers to promise by the prosecutor to recommend a specific sentence or to refrain from making any sentence recommendation in exchange for a guilty plea. Both methods affect the dispositional phase of the criminal proceedings by reducing defendant's ultimate sentence.

Components

The validity of a plea-bargaining is dependent upon three essential components.

- (i) A knowledge waiver rights
- (ii) A voluntary waiver
- (iii) A factual basis to support the charges to which the defendant is pleading guilty.

In 2001, the 178th report of the Law Commission once again reminded that the recommendations made in 154th report regarding plea-bargaining

Abstract

The term 'plea bargaining' is used to cover different things. It is sometimes used to describe discussions between prosecution and an accused's legal advisers concerning the charges upon which an accused will be presented for trial and including indications that the accused is prepared to plead guilty to certain offences. This may be described as

⁶ West's Encyclopedia of American Law.

⁷ (1978) I. see 579.

⁸ (1980) I. see 81 .

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should be made effective. Justice V. S. Malimath Committee Report on Reforms of Criminal Justice System 2003 had also endorsed the Law Commission's advice to incorporate pleabargaining in the Code of Criminal Procedure 1973 (Cr. P. C.).

The 14th Law Commission in its 154th report also made recommendation regarding introduction of the procedure of 'plea-bargaining' for the offences, which were punishable in the imprisonment for less than seven years and or fine including the offences, covered by Sec. 320 of the Cr. P. C .. It was clarified that plea bargaining can also be in respect of nature and gravity of offences as well as to the quantum of punishment.

With regard to its views on plea bargaining also the judiciary was not consistent. There has been cases where the victims were coaxed into plea bargaining. It came to be criticized by the Supreme Court in Pawan Kumar Vs. State of Haryana⁹ and Rao Singh Vs. State of Haryana¹⁰. But even the cases involving minimum sentences¹¹ the lower Court resorted to plea bargaining [Ganesh Jashraj Vs. State of Gujrat¹¹, Tippaswami Vs. State of Karnataka¹² Even in 2002 the Supreme Court have had occasion to criticize plea bargaining [in Habhajan Singh Vs. State of U.P.¹³. It was not an acceptable institution for our criminal justice system then.

Amendment in CPC

A new chapter XXIA has been added to the Cr. P. C. 1973 amendment of 2006 which insert Sections 265 A to L are:

- The plea bargaining is applicable only in respect of those offences for which punishment of imprisonment is upto a period of 7 years.
- It does not apply where offences that affect the Socioe-conomic condition of the country or has been committed against a woman or a child below the age of 14 years.

- The application for plea bargaining should be filed by the accused voluntarily.
- A person accused of an offence may file an application for plea bargaining in the Court in which such offence is pending for trial.
- Any Court had not previously convicted the accused in any case, in which he has been charged with the same offence.
- Once the Court is convinced that the accused is participating in the plea bargaining voluntarily, it will allow time to both parties to reach mutually satisfactory disposition, which may include giving to the victim by the accused, compensation and other expenses incurred during the case.
- The Court may release the accused on probation if the law allows for it, if a minimum sentence is provided for the offence committed, the accused may be sentenced to half of such minimum punishment and if the offence committed does not fall within the scope of above, then the accused may be sentenced to one forth of the punishment provided or extendable for such offence.
- The statement or fact stated by an accused in an application for plea-bargaining shall not be used for any other purpose than for plea-bargaining.
- The benefit under Section 428 Cr. P. C. of setting off the period of detention under gone by the accused against the sentences of imprisonment is permissible in plea bargained settlement as well.
- The Court must deliver judgment in open Court according to the terms of the mutually agreed disposition and formulas prescribed for sentencing including victim compensation.
- The Judgment delivered by the Court in the case of plea bargaining shall be final and no appeal

⁹ (1996) & scc 17.

¹⁰ (1998) & see 738.

¹¹ (1980) lsee 363

¹² (1983) lsee 194

¹³ (2002) lsee 407

¹⁴ At www.seliconindia.com

prosecutorial plea bargaining. The term also covers discussion in which the trial judge takes part. In such an arrangement counsel for the accused and the prosecution attend the Judge in his private Chamber and discuss upon the Judge indicating the probable sentence of the accused, through this counsel, indicates that he will plead guilty. This may be



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(except under Article 136 & writ petitions under article 226 and 227 of the Constitution of India) shall lie in any Court against such judgment.

It is interesting to note that it is for the accused to initiate steps for plea bargaining by way of application with its accompaniments. He has also to prove that he had not been convicted of the same offence. The Court may require all the parties concerned the complaint, Public Prosecutor and the accused to appear before him for discussions. He should ascertain by way of in-camera proceedings as to the willingness of the accused to participate in the proceedings. This is to avoid allegations of coercion of accused. If it is proved that the accused was coerced to make the application, he may be tried rather than proceeded under Sec. 265.

The execution of bargained disposition is ensured by authorizing Courts to invoke jurisdiction under S. 360 Cr. P. C. provisions of probation of offenders Act, 1958 or any other such Law.

Justification

The justification for plea-bargaining has been justified for a number of reasons. Some of those reasons articulated by Courts include :

- Plea bargaining permits a prompt resolution of Criminal Proceedings with all the benefits that result from final disposition and avoids delay and uncertainties of trial and appeal.
- Plea bargaining results into improved equity, in so far as rigid sentencing guidelines may fail to take into account a defendant's particular circumstances.
- Plea bargaining avoids much of the corrosive impact of enforced idleness during pretrial confinement for those who are denied release prior to trial.
- Plea bargaining protects the public from those accused persons who are prone to continue criminal conduct even while on pretrial release.
- Plea bargaining shortens the time between charge and disposition, thereby enhancing

whoever may be the guilty when they are ultimately imprisoned, and

- In the context of co-operation agreements, plea-bargaining serves a greater good by allowing the Government to prosecute higher-level criminals, where such prosecution would not be possible without the information or testimony of the cooperating defendant.

The concept of plea bargaining is a land mark step that many believe will help reform its legal system. Under the move an accused in a criminal case will be able to plead guilty in exchange for a reduced sentence. The Country's legal community who say it will go a long way in reducing pressure on the Courts has welcomed the move. Human Rights experts allege that many confessions in Indian cases are made under duress from the police. At the moment, India has 10 judges for every million people because of which the average length of trial is about 15 years¹⁴. The aim is to get cases in which the complainant may be less contentious and co-operative to dispose of the cases quickly. The success depends upon the willingness of the offender to confess and the agreement of the victim for a reduction in punishment. This plea bargaining is an alternative resolution system that should be welcomed and encouraged to wipe out the mounting arrears in the Courts.

The judgment delivered by the Court in the case of plea bargaining shall be final and no appeal shall lie in any Court against such judgment.

Conclusion

The success depends upon the willingness of the offender to confess and the agreement of the victim for a reduction in punishment. Indeed compensation has been imaginatively woven into the texture of plea bargaining. We would also like to mention that mere reforms, recommendations and change in the procedural and substantive laws are not the essential for achieving the noble goal of fair trial for all. It is a noble idea which must be protected and preserved in the minds of the people who are responsible for delivering justice to the citizens.

described as Judicial plea bargaining.

Key Words

Money Laundering
Drug Trafficking
Drug Abuse
Dirty Money
Clean Money
Vienna Convention

Drug Trafficking as a source for Money Laundering

Dr. M. Srinivasan*

Introduction

Money laundering can be described as the "turning of dirty money into clean money". It is the process of converting cash, or other property, which is derived from criminal activity, so as to give it the appearance of having been obtained from a legitimate source. There are various offences both under the Indian Penal Code and Special Laws which generate money laundering. The traditionally known criminal activities that generate money laundering include drug trafficking, trafficking of women and children, smuggling, counterfeiting, tax evasion, misappropriation of public funds, corruption, bank frauds and so on (Agarwal and Agarwal, 2004).

In India, though the problem of drug-trafficking is not alarming, it is becoming one of the major sources of generating money laundering. Hence, some of the basic issues that need to be addressed include how does drug trafficking as a criminal activity generate money laundering at the global level; what is the extent of drug trafficking in India; and how does drug trafficking become a source for money laundering in India.

Money Laundering : Meaning

One of the first formal definitions of money laundering to gain international recognition is that found in the United Nations' Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (commonly referred to as the 1988 Vienna Convention). The key elements of this definition include the conversion of illicit cash to a less suspicious form, so that the true source or ownership is concealed and a legitimate source is created. This definition was used by many countries when they drafted anti-money laundering laws (McDonell, 1998).

Money laundering generally involves a series of multiple transactions used to disguise the source of financial assets, so that these assets may be used without compromising the criminals who are seeking to use the funds via a three stage process, namely, **placement** (dirty money being inserted into the financial system through deposits, wire transfers or other means), **layering** (separates the proceeds, room their criminal origin by moving them through a series of financial transactions. This makes it harder to establish a connection between them) and **integration** (creating a legitimate explanation for the source of funds, allowing them to be retained, invested or used to acquire goods or assets) (Lal 2003)

Money laundering has become a critical issue for any criminal enterprise. Successful money laundering enables criminals to:

- remove or distance themselves from the criminal activity generating the profits, thus making it more difficult to prosecute key organizers;
- distance profits from the criminal activity - prevent them being confiscated if the criminal is caught;
- enjoy the benefits of the profits without bringing attention to themselves; and
- reinvest the profits in future criminal activity or in legitimate business (McDonell, 1998)

Money Laundering and Drugs: Global Scenario

An estimate by the United Nations International Drug Control Programme (UNDCP) showed that the illegal drug trade generates retail sales of about \$400

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billion a year, nearly double the revenue of the global pharmaceutical industry or about ten times the sum of all official development assistance. Due to globalization and liberalization, organized crime syndicates are taking advantage of open borders, privatization, free trade zones, weak states, offshore banking centres, electronic financial transfers, smart cards and cyber banking to launder millions of dollars in drug profits each day. Further, it is also estimated that there are about 700,000 wire transfers taking place everyday, and through which US\$2 trillion criss-crosses the globe. According to Tom Brown, Head of the four-person Anti-Money Laundering Unit of the International Criminal Police Organization, Interpol "Money laundering can be done anywhere so criminals pick the countries where the laws are either non-existent or they are lax or the police efforts are not strong enough to catch them" (United Nations, 1998).

Initiatives to Curb Laundering

To combat the problem of money laundering, a series of initiatives was taken by the international community. Some of the initiatives are outlined below:

- The United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (commonly referred to as the 1988 Vienna Convention) called for prevention of laundering of proceeds of drug crimes and other connected activities and confiscation of proceeds derived from such offence. The Government of India also ratified the Convention (United Nations, 2003);
- The Paris-based Financial Action Task Force (FATF), consisting of 34 nations (as of 2007), was set up at the 1989 Paris Summit of the Group of Seven Countries to prevent international money laundering. In 1990, the FATF developed 40 recommendations that provided a complete set of counter-measures against money laundering, covering the criminal justice system and law enforcement, the financial system and its regulation and international co-operation. Then, the recommendations were revised for the first time in 1996 taking into account changes in money laundering trends and anticipating potential future threats. In 2003, the FATF completed a thorough review and update of the 40 recommendations. With reference to the scope of criminal offence of money laundering, recommendation states that, "Countries should criminalize money laundering on the basis of United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988 (the Vienna Convention) and United Nations Convention against Transnational Organized Crime, 2000 (the Palermo Convention)." It further states that countries should apply the crime of money laundering to all serious offences, with a view to include the widest range of predicate offences. Predicate offences may be described by reference to all offences, or to a threshold linked either to a category of serious offences or to the penalty of imprisonment applicable to the predicate offence (threshold approach), or to a list of predicate offences, or a combination of these approaches (FATF-GAFI 2003);
- The Political Declaration and Global Programme of Action was adopted by United Nations General Assembly by its Resolution No. S-17/2 of 23 February 1990. This declaration called upon the member states to develop mechanisms to prevent financial institutions from being used for laundering of drug-related money and enactment of legislation to prevent such laundering (United Nations, 1990);
- The 1990 Strasbourg Convention on Laundering, Search, Seizure and Confiscation of the Proceeds from Crime, while considering the fight against serious crime, which has become increasingly an international problem, called for the use of modern and effective methods to fight against serious crimes (Council of Europe, 1990); and
- Since financing of terrorism is a matter of grave concern to the international community as a

Abstract

Money laundering is the process of converting cash, or other property, which is derived from criminal activity, so as to give it the appearance of having been obtained from a legitimate source. There are various criminal activities that generate money laundering. Drug trafficking is also becoming one of the major sources of generating money laundering in India.

Drug Trafficking as a source for Money Laundering

Based on the approximate cost of the drugs, the total money involved in the drugs that were seized during the year 2006 was computed by the author of the present paper. This rough estimate shows that more than 89 crores of rupees were involved. If the drugs that do not result into seizure and are successfully marketed are roughly around 10 times of the size of the seized drugs, the money involved would have been around 890

Table-1: Seizures of Narcotics and Drugs over the Period from 1995 to 2006

S.No	Drugs	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1.	Opium	871	977	1125	868	927	1257	1205	1167	895	760	742	1098
2.	Morphine	35	37	39	45	125	142	146	148	266	241	135	190
3.	Heroin	3236	3043	2866	2713	2937	2841	3891	4328	5600	4058	4482	5490
4.	Ganja	5737	5833	6624	5809	6518	6073	7613	3687	9330	3719	3458	6306
5.	Hashish	2691	2593	1920	1771	2500	2078	2117	2121	1738	1735	1788	2232
6.	Cocaine	6	8	5	4	4	5	10	5	10	14	23	47
7.	Methaqualone	196	405	207	112	8	31	8	7	6	3	7	4
8.	Phenobarbital	-	-	-	-	-	11	-	-	-	-	1	-
9.	L.S.D	1	7	-	1	3	-	-	-	-	7	-	-
10.	Acetic	26	14	11	7	7	14	8	4	6	1	5	4
	Anhydride												
11.	Ephedrine	-	-	-	-	-	8	5	4	8	4	2	-
12.	Amphetamine	-	-	-	-	-	-	-	-	-	-	1	5
	Total	12799	12917	13908	12446	13029	12460	15003	11471	17859	10542	10643	15376

Sources: Crime in India, 1995-2006

Drug Trafficking as a source for Money Laundering



Table-2: Quantity of Drugs Seized over the Period from 1995 to 2006 (qty in kgs)

S.No	Drugs	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1.	Opium	1339	2875	3045	1834	1635	2684	2533	1867	1635	2225	1067	2756
2.	Morphine	4	4	36	14	36	39	26	66	109	97	47	36
3.	Heroin	1678	1257	1122	597	861	1240	889	933	1008	1156	899	1130
4.	Ganja	121873	62992	76336	62591	40113	100056	86929	93477	79483	1402165	110600	144329
5.	Hashish	3629	6520	2656	8478	3391	5041	5664	4487	3012	4555	3868	3838
6.	Methaqualone	20485	2212	1740	2087	474	1095	2024	7458	593	1614	469	4420
7.	Cocaine	40	3	24	1	1	0.350	2	2	2	6	3	206
8.	Ephedrine	NA	NA	NA	NA	NA	-	930	126	3234	72	8	1276
9.	Acetic Anhydride (in litres)	NA	NA	NA	NA	NA	1337	8589	3288	857	910	298	133
10.	L.S.D	NA	NA	NA	NA	NA	-	-	-	-	2665	-	-

Source: Crime in India, 1995-2006. NA- Data Not available

crores of rupees. Hence, in the present paper, attempts were made to address the key issue, namely how does drug trafficking become a source for money laundering in India.

Drug Trafficking as a source for Money Laundering

whole and the number and seriousness of acts of international terrorism depend on the financing that terrorists may obtain, the International Convention for the Suppression of the Financing of Terrorism was adopted by the United Nations General Assembly in January 2000 (United Nations, 1999).

Indian Scenario

In India, though the problem of drug-trafficking is not alarming, it is becoming one of the major sources of generating money laundering. "Crime in India", annual publication of the National Crime Records Bureau, Ministry of Home Affairs, Government of India, includes data on the number of seizures of narcotics and drugs, quantity of drugs seized and value of property forfeited and frozen of drug traffickers.

The above tables (Tables 1, 2 and 3) show the number of seizures of narcotics and drugs over the period from 1995 to 2006, the quantity of drugs seized and the value of property forfeited and frozen during the same period. From Table-1, it can be inferred that there is a significant increase in the total number of Seizures of narcotics and drugs

during the year 2006 compared to years 2004 and 2005. It can also be inferred from Table -2 that Ganja and Hashish were the drugs that form the major quantity of drugs seized. For instance, during the year 2005, 11,0600 kgs of ganja and 3868 kgs of Hashish were seized; during the year 2006, 144329 kgs of ganja and 3838 kgs of Hashish were seized. With regard to the value of property forfeited and frozen during the year 2003, 2004 and 2005, no property of drug traffickers was forfeited, while in 2006 1.53 lakhs were forfeited; in 2004, 68.4 lakhs worth of property, in 2005, 37.69 lakhs and in 2006 202.89 lakhs worth of property were frozen. From the quantity of drugs seized, it is also possible to calculate the amount involved in drugs that were seized. In the following table, total quantity of drugs seized during the year 2006 and the total money involved in such seizures have been presented.

Based on the approximate cost of the drugs, the total money involved in the drugs that were seized during the year 2006 was computed. This rough estimate shows that more than 89 crores of rupees were involved. If these drugs were not seized and successfully distributed in the market, the money obtained out of such criminal activity would have

Table-3: Value of property forfeited and frozen of drug traffickers (amount in lakhs)

S.No	Year	Value of Property (in lakhs)	
		Forfeited	Frozen
1.	1995	3.0	2104.2
2.	1996	13.7	16.6
3.	1997	10.6	154.8
4.	1998	238.5	306.4
5.	1999	61.6	74.6
6.	2000	132.4	53.7
7.	2001	16.3	20.9
8.	2002	236.4	52.3
9.	2003	-	49.5
10.	2004	-	68.4
11.	2005	-	37.69
12.	2006	1.53	202.89

Source: *Crime in India, 1995-2006*



Drug Trafficking as a source for Money Laundering

**Table-4: Total quantity of drugs seized during the year 2006,
Approximate Cost of 1 kg of Drugs and the Total Amount Involved**

S.No	Type of drugs	Total quantity of drugs seized (in kgs)	Approximate cost of 1 kg (in rupees)	Total amount involved (in rupees)
1.	Opium	2756	15,000	41,340,000
2.	Morphine	36	10,000	360,000
3.	Heroin	1130	400,000	452,000,000
4.	Ganja	144329	2000	288,658,000
5.	Hashish	3838	15,000	57,570,000
6.	Methaqualone	4420	10,000	44,200,000
7.	Cocaine	206	10,000	2,060,000
8.	Ephedrine	1276	10,000	12,760,000
9.	Acetic Anhydride	133	1000	133,000
10.	L.S.D	-	1000	-
			Grand total	899,081,000

been laundered through various means. Hence, it is also important to understand the number of drug-trafficking cases that do not result in seizure. If the drugs that do not result into seizure and are successfully marketed are roughly around 10 times of the size of the seized drugs, the money involved would have been around 890 crores of rupees. Therefore, one should not go by the quantum of drugs seized alone in order to understand to total money involved in drug trafficking. For this purpose, it is advisable to conduct micro-level surveys to know the nature and extent of drug abuse among the general population. The outcome of such surveys would supplement in computing the extent of drug trafficking and the total money involved in such trafficking. It is also worthwhile to mention in the Prevention of Money Laundering Act, 2002 that came in the force in July 2005, drug trafficking is also included as offence.

Drug Trafficking & Drug Abuse Containment & Prevention

The World Drug Report (2007) published by United Nations Office on Drugs and Crime (UNODC) shows that the world drug problem is being contained in terms of cultivation, production and consumption.

But one may also observe notes of caution on drug trafficking in the preface of the above report by the Executive Director of the UNODC. It is stated that: "Many trafficking routes traverse zones of instability, and where corruption negates interdiction. The challenge is to block these routes by increasing law enforcement, stopping the diversion of precursor chemicals, improving the integrity of the judicial system, and - not least -- fighting corruption among officials at borders and in local administrations. Otherwise, as in parts of Central America, the Caribbean and the Balkans, countries will be caught in the crossfire of drug-related crime". This emerging threat needs to be addressed to contain drug-related crime, money laundering and corruption. Further, if the problem of drug is to be reduced in the longer term, there must be more intervention at the level of consumption. Therefore, efforts also have to be made to prevent the spread of drug use that could cause havoc in a country like India.

Reference

Agarwal, J. D., & Aman, A. (2004). 'Globalization and International Capital Flows'. *Finance India, Vol. XIX No. 1.*

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Council of Europe. (1990). Convention on Laundering, Search, Seizure and Confiscation of the Proceeds from Crime. Retrieved [http:// Conventions. Coe.int/treaty/en/ Treaties/ Html/141. htm-47k](http://Conventions.Coe.int/treaty/en/Treaties/Html/141.htm-47k).

FATF-GAFI. (2003). The 40 Recommendations. Retrieved 27 September 2007 from [http:// www.fatf-gafi.org | document/ 28/0,3343, en 32250379_3223693033658140 _1_1_1_1,00. html#40_recs](http://www.fatf-gafi.org/document/28/0,3343,en32250379_3223693033658140_1_1_1_1,00.html#40_recs).

Government of India. (1996-2005). 'Crime in India, 1995-2005'. New Delhi: National Crime Records Bureau.

Lal, B. (2003). 'Money Laundering: An Insight into the Dark World of Financial Frauds'. Delhi: Siddharth Publications.

McDonell, R. (1998). 'Money Laundering Methodologies and International and Regional Counter-measures. *Gambling, Technology and Society*'.

United Nations. (1990). Political Declaration and Global Programme of Action (Resolution No. S-17/2) [UN General Assembly].

United Nations. (1998). Money Laundering [UN General Assembly Special Session on the World Drug problem]. Retrieved 27 September 2007 from [http:// globalsecurity.org | intell | library | news | 1998 | 06 | launder.htm](http://globalsecurity.org/intell/library/news/1998/06/lauder.htm)

United Nations. (1999). International Convention for the Suppression of the Financing of Terrorism. Retrieved 27 September 2007 from [http:// untreaty.un.org/ English/ Terrorism IConv12. pdf](http://untreaty.un.org/English/Terrorism/Conv12.pdf).

United Nations. (2003). United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988. Retrieved 27 September 2007 from [www. Untreaty.un.org/ English | TreatyEvent20031 Texts/ treaty 7E.pdf](http://www.untreaty.un.org/English/TreatyEvent20031Texts/treaty7E.pdf).



Firearms used by Naxalites A Forensic Study

Dr. Swaroop Vedanand*, Mr. C.Narayana Rao* & Mr. O.N.Murthy*

Introduction

It is well known that contemporary Naxalism takes its popular title from the failed peasant revolt that commenced at Naxalbari in the Darjeling district of West Bengal in 1967. In recent years, Naxalism has spread into less developed areas of rural, central and eastern India, such as Bihar, Jarkhand, Orissa, Chattisgarh and Andhra Pradesh through the activities of underground groups. This Left Wing extremism has had a more persistent and sound base in the Telengana region of Andhra Pradesh for a long time. According to Judith Vidal-Hall (2006), "More recent figures put the strength of the movement at 15,000 and claim that the guerrillas control an estimated one fifth of India's forests, as well as being active in 160 of the country's 604 administrative districts [1].

Over one-third of India is affected by Naxalite violence which is shown in Figure-1. Far from being contained, Naxalite ideology seems to be spreading. In the last two years alone, nearly 35 more districts have come under its impact, taking the number of districts affected to 160. On August 15th, 2006 in his Independence Day speech in Delhi, India's Prime Minister Dr.Manmohan Singh linked Naxalism with terrorism as the two big threats to India's internal security. The Central Government of India views the Naxalite menace as an area of serious concern. The Ministry of Home Affairs (MHA) along with the 13 Naxal-affected states had elaborate discussions during last year to chalk out strategies to tackle Naxalism.

The Naxalites openly oppose and disrupt major ongoing developmental projects, while others are compromised as a result of huge extortion demands. The strongest opposition is to developmental activities, the construction of roads

and communication links to the backward and tribal areas, since success in these areas may attract the poor into placing their faith in the institutions of democracy and constitutional government. To hinder the government's developmental initiatives and reforms is, consequently, integral to the survival of the Naxalite movement, and is one of the objectives actively and tenaciously pursued.

Ideology

The Naxalite ideology - "governance only through the barrel of a gun" and their activities have posed a law under problem in India. In 2004, the Home Ministry estimate puts numbers at that time as "around 6,500 regular weapons beside a large number of unlicensed country-made arms". Naxals' main source of income is extortion. An amount of Rs.100 crores per year is collected from contractors, traders, businessmen, professionals like Doctors, Lawyers, Accountants and even government officials. Intelligence sources, in fact, indicate that this is an underestimate, and roughly Rs. 40-50 crore is extorted by the Naxals in Andhra Pradesh alone each year [2]. Large portion of this amount is being spent by them for procuring firearms.

In recent times Naxalites started using Improvised Explosive Devices (IEDs) like land mines, etc. for attacking the police and creating terror. Strict measures taken by the Government has restricted the Naxals in procuring the explosive material. So they are forced to depend primarily on firearms for their activities. Number of firearms seized from Naxalites in Andhra Pradesh from January 1990 to March 31, 2000 are given below in Table-I

Key Words

Naxalites,
Firearms,
Ammunition,
Country made
firearms,
Andhra Pradesh,
Left wing Extremism.

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Firearms used by Naxalites : A Forensic Study

Abstract

Over one-third of India is affected by Naxalite violence. Naxalism and terrorism are the two big threats to India's internal security. The Naxalite ideology - "governance only through the barrel of a gun" and their activities has posed a law under problem in India. The present study deals with the type of firearms used by the Naxalites in Andhra Pradesh. A statistical data of firearms and ammunition which are

Table -I

Year	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00
No. of firearms	105	126	487	267	137	184	132	263	340	280	72

The present study deals with the type of firearms used by the Naxalites in Andhra Pradesh. A statistical data of firearms and ammunition which are seized from the Naxalites and are sent to APFSL for examination during the year 2001 to 2005 is carried out in this paper. This information is helpful to the Government and the police in developing strategies and taking necessary precautionary measures in combating Naxalism in India.

Data Analysis

For the present study, the cases examined in APFSL

other two regions i.e. Rayalaseema and Coastal Andhra.

Telangana region of Andhra Pradesh was used to be strong base for the Naxalites for the past three decades. But past one decade, the influence of Naxals is more in most of the districts of Telangana region except in Hyderabad and Rangareddy. Their influence has increased in Ananthapur District in Rayalaseema and Guntur, Visakapatnam & Vizainagaram in Coastal Andhra.

Table -II

Year	2001	2002	2003	2004	2005
No. of cases	205	155	209	91	220

during the year 2001 to 2005 pertaining to Naxals are taken and a statistical data base is created for analysis. During these five years in total there are 880 cases. Year wise numbers of the cases are presented above in Table III.

In the year 2004 the newly elected Government lifted the ban on Naxalites, who are also called 'Peoples War Group(PWG)' in Andhra Pradesh and initiated peace talks but they could not succeed. The ban again imposed on PWG in the year 2005. This is the reason we can find the number of cases were reduced considerably in 2004. Andhra Pradesh is broadly divided into three divisions. Southern four Districts are called Telangana and Eastern region adjacent to the sea coast is called Coastal Andhra. Region wise distribution of cases is presented in Figure-2. Figure-2 clearly indicates that there were more cases in Telangana region when compared to

Firearms

In all these cases several firearms both company made and country made were examined. Number of firearms that were received in each year is shown in Figure-3. The data shows Naxals are having many country made firearms apart from regular company made firearms. These country made firearms are made in such a way that these can fire standard ammunition.

Apart from regular firearms that are available in India, various kinds of special caliber firearms were also seized from the Naxalites. They are presented in the Table-1. This indicates that the Naxals have access to foreign sources from where they are procuring these firearms. The Number of firearms having special calibre is considerably less when compared to the other regular firearms.

Table -III

Year	2005	2004	2003	2002	2001	Total
Company made	233	78	108	130	125	674
Country made	168	39	126	90	155	578

Firearms used by Naxalites : A Forensic Study

The number of firearms that were recovered from Naxalites in each district are presented in Figure-5. This figure indicates the Warangal district in Telengana region tops in all the districts. Also number of firearms of different calibre which were used by the Naxals is shown in Figure- 6 and Figure-7. The above figures indicate that the 8mm rifles and 12 bore shot guns are more in number, predominantly used by Naxalites. The 0.303' caliber rifles come next. When it comes to the small arms, revolvers are used more than pistols. Most common is 0.380" caliber revolver among the small-arms. The other revolvers used are 0.32" caliber and 0.45" caliber. When it comes to pistols, 9mm and 7.65 mm caliber are more in number. Figure-7 shows that the country made Revolvers and Pistols of other calibre are also more in number. Country made Revolvers and Pistols are preferred by the Naxalites because these can be easily concealed and carried even while they are moving in public.

Number of country made firearms of different caliber that are seized from Naxalites are shown in Figure-8. The Figure-8 indicates that among the country made firearms, 12 bore and 8mm calibers are more in number. This is probably because of the easy availability of their ammunition. Among the country made 12 bore and 8mm calibre firearms, pistols are more in number than the long barrel guns.

It is also observed that the prohibited caliber firearms i.e. 0.303" and 7.62 mm SLR used by the Naxalites. Some of these firearms could have been stolen during their raids on Police Stations. However, the numbers in figures are larger than the expected indicating that this could be due to pilferage of the arms and ammunition to the Naxalites from the government agencies. It has become advantage for the Naxalites in procuring the arms and ammunition as strict measures are not implemented by the government.

Ammunition

The number of Ammunition of the firearms of different caliber which were seized from the

Naxalites is shown in Figure-9. We can also observe that most of these country made firearms are made to chamber standard caliber ammunition which are easily available. Though country made firearms are made in large numbers, country made ammunition is rare because of the complexity involved in making the ammunition. Since the ammunition is easily available in the market, the firearms are made locally to fire the available ammunition. Failure of implementing strict measures in selling the ammunition in large quantities has given access to the Naxals in procuring the ammunition for their activities.

In the recent past, the Government imposed a ban on hunting so as to preserve the wild life. In the present scenario when hunting is prohibited, providing license to have firearms for hunting purpose i.e., firearms like 12 Bore and 8mm caliber is not justified. Since there is no control over selling the ammunition of these calibers, it has created scope for manufacturing country made firearms which can chamber this ammunition. These firearms are not only used by Naxalites but also by other criminals. Considering the Law and order situation of the country banning the civilian firearms of 12 bore and 8 mm rifle has to be examined. In one way lack of strict measures on firearms & ammunition and implementing them has creating other Law & Order problems. In view of the above, Government should make necessary amendments in the laws for preventing people from procuring arms and ammunition in large quantities, so that their misuse can be restricted.

Recommendations

Based on the above observations, the following recommendation are suggested to counter the Naxalism which is depending heavily on firearms for their activities :

- Necessary amendments in the law should be made so as to control use of Arms and

seized from the Naxalites and are sent to APFSL for examination during the year 2001 to 2005 is presented in this paper. The data clearly indicate that there were more cases in Telengana region when compared to other two regions i.e. Rayalaseema and Coastal Andhra in Andhra Pradesh. In Telengana region, Warangal district is on the top, in respect of number of firearms seized. Apart from regular firearms that

Firearms used by Naxalites : A Forensic Study

ammunition and to restrict their misuse.

- Strict measures should be imposed to restrict the selling of the ammunition in large quantities.
- In view of ban on hunting to preserve the wild life, use of the 12 Bore shot guns and 8mm caliber rifles should also be banned.
- Strict measure should be taken to stop pilferage of the arms and ammunition to the Naxals hands from the government agencies.

References:

Judith Vidal-Hall, "Naxalites", p. 73-75 in Index on Censorship, Volume 35, Number 4 (2006).

Das, Ashok, "Naxalism: Y2K problem sans solution?", The Hindustan Times, New Delhi, February 10, 2000.

"Report of the Advocates" committee on Naxalite terrorism in Andhra Pradesh, appointed by the High Court of Andhra Pradesh by its order dated April 4, 1997.

Table 1: Special Caliber Firearms Siezed From Naxalites

Sl.No.	Caliber	Firearms	Ammunition
1	0.50 / 0.465" Cal. Rifle	1	7
2	0.500" Cal. DBBL Rifle	2	21
3	0.45" cal TSMG [Thomson Sub Machine Gun]	1	20
4	0.401" cal SLR	1	
5	0.44" cal Carbine	1	
6	0.450" / 400 DBBL Rifle	1	20
7	6.5 X 57 mm Rifle	3	5
8	0.25" cal Rifle	1	
9	0.470" cal Rifle		11
10	0.360" cal Rifle		2
11	8 X 57mm Cal Rifle		82
12	16 Bore SBBL gun	1	
13	20 Bore SBBL Gun	1	
14	7.63 mm Cal Mouser Pistol	9	38
15	6.35 mm Cal. Pistol	2	21
16	0.22" Cal. Pistol	1	13
17	7.62X25 mm cal. Mouser Pistols	2	3

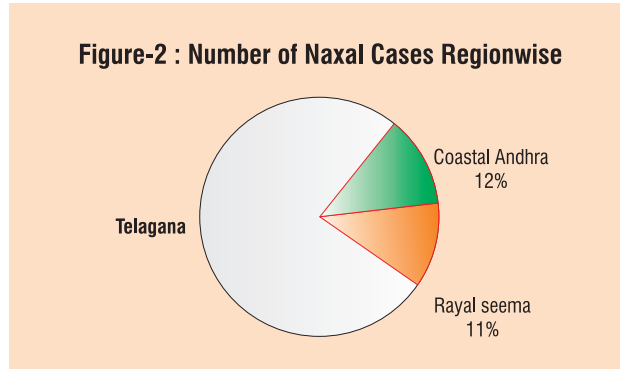
are available in India, various kinds of special caliber firearms that were seized from the Naxalites are presented.

The statistical data indicate that Naxals are using predominantly 8mm rifles and 12 bore shot guns which are more in number when compared to other firearms because of the easy availability of their ammunition. Country made Revolvers and Pistols are preferred by the Naxalites because they can be easily concealed and carried

Firearms used by Naxalites : A Forensic Study

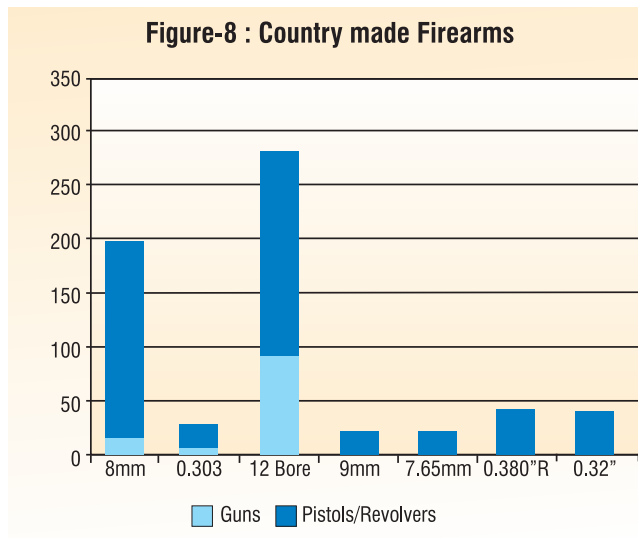
while they are moving in public. Country made 12 bore and 8mm pistols are more in number than the long barrel guns. Based on the observations strict measure to restrict the selling ammunition in large quantities and banning of 12 bore guns & 8 mm rifles and their ammunition are suggested to counter the Naxalism.

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Notes for Contributors

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The journal covers articles of general police interest as well as research papers based on empirical data pertaining to police work. Authentic stories of criminal case successfully worked out with the help of scientific aids and techniques are also published. Only original manuscripts are accepted for publication. Articles submitted to the journal should be original contribution and should not be under consideration by any other publication at the same time. A certificate to this effect should invariably accompany the article.

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R. No. 4607/57

The Indian Police Journal

LVI NO.2

April -June, 2009