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Forensic science has played a pivotal role in Criminal Justice System in all societies. Even though the concept of forensic science is not a new one, the proliferation of sophisticated crimes requires the crime investigators to be one step ahead in the science of forensics. From 1890s when Fingerprint evidence was first accepted in an Argentine court till now when DNA fingerprinting is a routine tool of forensics, the science has progressed manifolds. The purpose of forensic science is to provide guidance to criminal investigators and to supply to courts accurate information upon which they can rely in resolving criminal and civil disputes. It is imperative on the investigators to keep pace with the technological advancement in the crime detection methods starting from crime scene protection, methods of collection, preservation and maintenance of chain of custody of evidences at various stages.

"Every contact leaves a trace" and there are none that Forensic experts cannot pick up from the crime scene. Thus forensic evidence is an essential and

efficient enabler in the dispensation of justice in criminal, civil, regulatory and social contexts and exoneration of innocents. Well known techniques such as fingerprint analysis, DNA analysis, ballistics, polygraph lie-detection etc. have become powerful tools for the investigators. With infusion of technology, investigators now utilize scientific tools and techniques to detect a crime, reconstruct the crime scene, identify the alleged offender and establish vital links; the courts, on the other, take account of these physical evidences, otherwise infallible, and determine with enhanced accuracy the innocence or guilt of the offender.

A forensic scientist is an "expert witness" at trial. Even though he/she does not testify to the facts of the case, the expert provides interpretation of those facts to the court. Forensic scientific evidence has won for itself an aura of authority so much that it verges on infallibility. This makes flawed expert evidence a source of potential injustice when failure of forensics can lead to innocents landing up behind bars. Growing reliance on forensic evidence may turn into a double edged sword. The vulnerability is because of the areas subject

to misinterpretation. To begin with, scientific evidence is circumstantial. Though it may give strong evidence of the offender's identity or presence at the crime scene but it has at best very little, and generally no value in proving other elements of criminal liability such as intent, grounds of excuse, justification, or the absence of the victim's consent. In other words, it leaves considerable scope for interpretation. Therefore collection of other evidence by the investigators is as important. Strong counter expertise by opposite side contradicting scientific evidence in front of courts compound the difficulties faced in administration of justice.

Somewhere, the efficiency and effectiveness of the criminal justice functioning has come to be deeply intertwined with the extent of use of technological tools in crime investigation. The need of the hour is to remould the legal structure and its allied subsidiaries towards the achievement of result oriented forensic investigation and trial. The scientists must be able to convey their often complex subject as simply as possible. Only then will the investigators and lawyers be

able to present the evidence to the courts to reach a secure and informed decision.

Greater coordination and understanding between these two academic disciplines of law and science will help go a long way in building the public confidence in the legal system. Hope this volume of the Journal will kindle an aptitude for forensic sciences amongst all the stakeholders in the criminal justice system. This edition brings out contributions from the various practitioners of forensics from the science side and also from the legal application side. The entire scope of forensics is too broad to be covered in one issue, yet our attempt has been to bring out the latest papers conveying the paradigm shift in the use of forensic science in the criminal jurisprudence system. Hope you would find this special issue a worthy expenditure of your valuable time. Happy Reading!

Dr. B. Sandhya IPS
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UNUSUAL INCISED STAB WOUND BY A SINGLE EDGED WEAPON: A CASE REPORT

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ABSTRACT

Stab wound examination yields valuable information about the weapon. Some amount of information about the hilt can also be obtained at times. In this case of murder by stabbing, the cutting edge of the (single edged) blade had a blunt portion (ricasso) adjacent to the handle and the hilt was projecting beyond the cutting edge. The ricasso had modified the sharp cut end of the stab wound and the blunt end of the knife had

produced fish tailing. These events had altered the external appearance of the wound in such a way that the end which corresponded with the sharp edge of the knife looked blunt and the other end looked sharp. However, despite the confusing appearance of the skin wound, the actual orientation of the blade could still be determined from the hilt bruise.

INTRODUCTION

Stab wounds contribute a significant portion of trauma deaths. Refer figure 1, 2 and 3. From careful examination of the external appearance and internal characteristics of the stab wound, the pathologist is usually able to offer opinion upon the dimensions of the weapon (including width of the blade and minimum length); the type of the weapon (whether it was single edged or double edged); the taper of the blade; movement of knife in the wound 4; the depth of the thrust; the direction of the thrust and the amount of force used. Some information about the guard (hilt) can

also be gleaned from the presence of hilt bruises 5, 6. Accurate information about the type of weapon has special significance in crime investigations.

The type of weapon is determined by examining the margins and ends of the wound. If one end is sharply cut and the other end is either rounded off, square cut or shows splitting of skin (fish tail appearance), we can safely assume that the injury was produced by a single edged weapon.

However, this is an oversimplification. On occasion, both the ends may appear sharply cut even in single edged weapons. This can occur when the skin splits behind the blunt edge to produce a symmetrical appearance.5 This can also happen when the thrust is directed in such a way that, one sharply cut end of the wound is produced by the sharp tip of the knife7 and the other end is made by the sharp edge of the blade. In this situation, the blunt edge of the blade does not influence the shape of the wound.

The blade of a single edged knife often has a ricasso (blunt segment of the blade adjacent to the hilt). The significance of the ricasso is that the blade has two blunt edges at this portion. So if the knife is inserted up to the ricasso, the wound may have two blunt ends.

The injuries sustained to deeper tissues (especially cartilage or bone)6 can also be helpful in differentiating between the blunt edge and the sharp edge. It is possible that when the skin wounds are ambiguous, the type of the weapon can be determined with ease from a close examination of the deeper structures.

CASE REPORT

A 32 year old male was stabbed to death. The fatal injury was an incised penetrating wound situated on the left half of front of chest which had entered the chest cavity through the 3rd intercostal space, perforated the upper lobe of left lung and had terminated by entering the chamber of left

ventricle (Figure 1). The wound was horizontally placed and showed gaping of edges.

The length of the wound (measured after approximating the edges) was 3.6 cm. The medial end was rounded and showed an adjacent contusion measuring 0.5 X 0.4 cm (see Figure 1). The lateral end of the wound showed skin splitting giving the impression that it was sharply cut. On external examination, it appeared as though the wound was made by a single edged weapon and the blunt edge of the weapon corresponded with the medial end and the sharp edge with the lateral end.

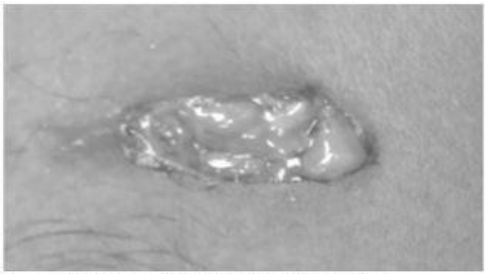

Fig. 1. The stab wound on the left half of front of chest.

Internal examination showed that the intercostal muscles, lung and myocardium along

the medial aspect of the wound track were sharply cut (Figure 2). On closer examination, it was noted that the lateral end of the wound showed two skin splits or "fish tailing" (Figure 3). strongly suggesting that the corresponding knife edge was square cut. The edges of gaping wounds need to be approximated to clearly visualize the shape of the wound and accurately measure the dimensions.

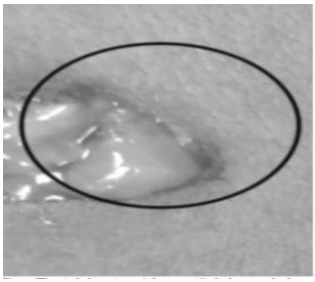

Fig.3 The circled portion of the magnified photograph shows ''Fish tailing''. The lower ''tail'' could be easily confused as sharp end of the wound and the upper 'tail' is easily misinterpreted as a side cut or overlooked.

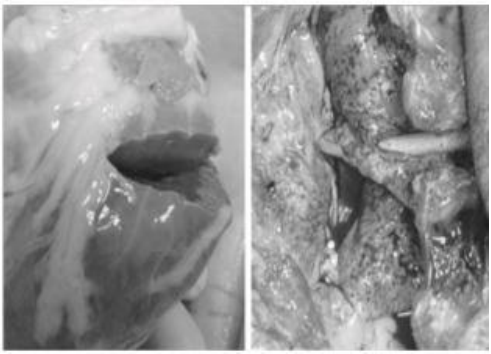

Fig.2. The picture on the left shows the myocardial injury. The picture on the right shows the injured left lung with a probe passed through the wound track.

WEAPON

The weapon recovered by the investigating agency was of a peculiar design (Figure 4). The maximum width of the sharp portion of the blade was 3.4 cm just above the ricasso. The ricasso was projecting beyond the cutting edge but was continuous with the spine of the knife (the square edge). The blade was 3.6 cm broad at the level of the ricasso. The hilt was seen to be projecting another 5mm beyond the ricasso. The shape and placement of the contusion (hilt mark) adjacent to the medial end of the stab wound corresponded well with the hilt of the suspected knife. The width of the blade (at the level of the ricasso) corresponded with the length of the wound.

The spine of the blade had a thickness of 0.3 cm and had a square cross section which corresponded with the presence of fish tailing.

Fig 4: The knife recovered. Note the rounded and prominent ricasso below the cutting edge. The hilt which projected beyond the cutting edge corresponded well with the confusion adjacent to the medial end of the skin wound.

DISCUSSION

From a careful analysis of the findings, it was possible to deduce which end of the wound corresponded with the sharp edge of the knife and which end corresponded with the blunt edge even though cursory examination suggests the opposite. Rounded end of a wound does not necessarily mean that it was produced by the blunt edge of a blade; the rounded ricasso may well be the reason why the clues like hilt marks and internal injuries are important and must be weighed carefully before an opinion about the type of weapon is furnished

end is rounded. It should also be kept in mind by that skin splitting produced by the blunt edge of a knife may cause the wound to appear like sharply cut.

REFERENCES

1. Lyn-Sue J, Siram S, Williams D, Mezghebe H. Epidemiology of Trauma Deaths in an Urban Level1 Trauma Center Predominantly among African Americans—implications for prevention. J Natl Med Assoc. Dec 2006;98(12):1940-4.

2. Karch DL, Dahlberg LL, Patel N, Davis TW, Logan JE, Hill HA. Surveillance for violent Deaths— National Violent Death Reporting System, 16 States, 2006.MMWR Surveill Summ. Mar 20 2009;58(1): 1-44.

3. Ambade V.N., Godbole H.V. Comparison of wound patterns in homicide by sharp and blunt force. Forensic Science International January 2006; 156 (2), 166-170

4. Singh VP, Sharma BR, Harish D, Vij K., A Critical Analysis of Stab wound on the Chest. A Case Report. JIAFM, 2004; 26(2). ISSN 0971-0973

5. Sauko P., Knight B. The Pathology of Wounds. Knight's Forensic Pathology. 3rd ed., Arnold Publishers, London; 2004 p 157-158

6. Lew E., Matshes E. Sharp Force Injuries. Forensic Pathology Principles and Practice. Elsevier Academic Press, Burlington, USA 2005 p 143-162

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"Should there be any inaccuracy in an autopsy report, injustice would remain with the deceased as well as the living" - (Song Ci- AD 1235)

FORENSIC SPEAKER RECOGNITION

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Forensic science and criminal investigations go hand in hand which mostly leads to admissible judgement over many criminal cases. More than any other evidences, forensic evidences are far more acceptable in courts. This is due to the fact that forensic science produces the evidences based on strong foundations of scientific methods and technology. Forensic analysis of the biometric features provide double strong evidences because

of the fact that scientific methods and analysis are applied to features unique to individuals making the evidences unbreakable.

Speech is one of the many biometrics which can be used to produce evidence in criminal investigations. The speech collected from a crime scenario (trace) can be used to identify or verify a culprit (source) [1] using algorithms and software developed for the purpose. This application of automatic speaker recognition (ASR) in forensics is called forensic automatic speaker recognition (FASR or FSR). The advancement of technology also makes it possible to collect trace by several means.

Speaker identification and verification are two tasks in speaker recognition system. In identification, a speaker has to be identified from a test speech sample by comparing with a set of previously stored speech samples. Speaker identification may be open set or closed set. In open set, it is assumed that the intended speaker need not be present in the training set. So here

speaker is identified by setting a threshold score. In closed set, the intended speaker is assumed to be present in the database. So identification is done by selecting the maximum scored speech samples. In verification, a one to one matching is done between the questioned speech and the speech from the suspect by setting a threshold match score. It is a binary decision system. In forensics, both are required. In fact verification is very important in FSR.

Among the deferent biometrics, speech has distinguishable properties and challenges. Even though forensic science is in a matured stage for analysis of most of the biometrics, FSR is still in its infancy. The main reason for this is that, it is not easy as it is for other biometrics, to get a clean speech. Speech is highly vulnerable to many distortions like noise, multiple speakers, channel effects, codec distortions, inter and intra speaker variations, encryption, echo, mimicking and lot more. Since in FSR, the speech collected from

crime scenario is compared against the speech of a suspected person, the accuracy of the comparison greatly depends on the cooperation of the accused. Distortions occur for speech in all ASR applications like telephone banking, flight booking, etc, but forensic evidence speech suffers from unpredictable and combined distortions. Poor quality of speech, short duration of speech samples, mismatches in training and testing conditions, mimicked speech, whispered speech, compressed speech and encrypted speech are the major challenges to be addressed in FASR.

History

The known history of forensic speaker recognition started in the seventeenth century itself in the trial of King Charles I of England. Discussions for use of technology for forensic speaker recognition has been made in the 1920s itself and the first court case involving scientific investigation of voice was done in 1937 in the case of abduction of Charles A. Lindberg's son. Considering audio files

in forensics started in the 1950s after the invention of live recording systems outside the recording studio and in 1960s, in Federal Bureau of Investigation in the United States, experts in audio forensics were developed. In earlier stages of speaker recognition in forensics (1970s), voice print or spectrograms of speech was analysed. Spectrographic representation was developed at AT&T Bell Laboratories during World War II. They are simply the graphical representation of voice.

Some of the well-known earlier examples of speech analysis in forensics for identifying the source are: voice analysis done on tapes said to be made by Osama Bin Laden in 2002, following six attacks by different radical Islamic groups; an anonymous 13 second 911 call warning a bomb explosion in Centennial Olympic Park in Atlanta, during the 1996 Olympic Games and Trayvon Martin Shooting case of 2012 with the central question who was heard crying for help on a 911 call in the moments before the teen was shot.

The enormous practical difficulties in the speaker recognition in forensics has led the researchers to analyse the problems very carefully and at an abstract level and come up with different solutions applicable, which all ultimately aimed at reducing the error of identifying the speaker of a speech sample correctly. Some of the established FASR systems are SASIS, SAUSI and C.A.V.I.S. (U.S.A.), AUROS, SPES (Germany), IDEM (Italy) and IdentiVox (Spain).

Methodology

There are mainly 3 steps in all ASR systems: feature extraction, modeling and decision making by score interpretation. Speaker specific acoustic features aid the speech independent speaker recognition applications and thus it is the first stage in ASR. Extracted features should uniquely represent the specific speaker. It should some way support to reveal the speaker identity. After selecting the proper feature set, next stage in speaker recognition is modeling. In this the

features extracted in the first stage is used to create a model for each speaker in the training set. The score calculated for both the training and testing speech samples are then matched and the speaker is identified. In FSR all these stages should be highly robust against deferent types of possible distortions.

Speaker recognition accuracy in forensics can be improved by improving feature extraction, both feature type and extraction methods, modeling algorithms and also improving score calculation and interpretation. But in forensics, yet other scopes of improvement are in enhancing the speech sample and in score interpretation. Speech enhancement methods play very important role in forensic speaker recognition. These include preprocessing techniques, voice activity detection and noise and distortion removal.

We have low level acoustic features to high level supra segmental features. Low level features are related to speech production system. They have

low dimension. These include Mel-Frequency Cepstral Coeffcients (MFCC), Minimum Variance Distortionless Response (MVDR), Frequency Domain Linear Prediction (FDLP), Mean Hilbert Envelope Coefficients (MHEC), Spectral Centroid Features (SCF), Spectral Centroid Magnitude (SCM), Fundamental Frequency Variation (FFV) features, Harmonic Structure Cepstral Coefficients (HSCC), Multitaper MFCC etc. High level features are related to style of speaking, habits of speaking etc. They include phonetic, prosodic and lexical observations. It is observed that high level features are more suitable in forensic applications after the 2002 Super SID project of 2002 JHU CLSP summer workshop. They are easy to interpret and are suitable to estimate the likelihood ratios. They dramatically increases the speaker recognition accuracy. As alternatives to MFCC, we can use prosodic and auditory features which are noise robust.

The role of classification in FSR is also very important. Vector Quantization, Gaussian Mixture Model (GMM), Hidden Markov Model (HMM) and Neural Network (NN) modeling such as Multi-Layer Perceptron (MLP), Generalized Regression Neural Network (GRNN), Radial Basis Function (RBF) etc are the current approaches in modeling. Deep neural network approaches, missing data technique in UBM etc are some of the advancements in modeling techniques that are robust to noise. GMM is one of the best classifiers of all the state-of-the-art methods. Some of the performance metrics in ASR are, equal error rate (EER), probability of false acceptance and percentage identification.

The verification results from the classifiers have to be interpreted more accurately in forensics. This is called the strength of the evidence. To an extent, probability measures are used. But more meaningful interpretations are also developed. It is very important to prove the strength of the evidence in court. So estimating and presenting the

validity and reliability measures are important in forensic comparison systems. This is in fact the most important and unique aspect in FSR. Several methods are adopted for this. The log-likelihood ratio cost is reviewed as a good metric of validity. Forensic likelihood ratio calculation is mainly based on formant trajectory measurement during the past few years. Formant trajectories are often used in forensics by linguists and phoneticians to prove the evidence in court analyses the Bayes' theorem likelihood ratio in correctly proving the strength. Since the score value in Bayesian framework corresponds to the ratio of two likelihood values, it does not give an understandable representation. In authors proposed a method to interpret these ratios by an a posteriori probability. In, author points out the importance of accepting speaker identification result in a court. The paper explains how evidence has to be explained in court. It is important that FASR methods provide probabilistic evaluation which indicates the strength of the

evidence. For this, the author suggests a method for processing and interpreting the evidence. This method was developed at the Swiss Federal Institute of Technology at Lausanne and the University of Lausanne, in the collaboration framework of the European Network of Forensic Science Institutes. The available forensic methods should be tested against all known adverse factors found in the evidentiary recording. Currently the most important criterion imposed for forensic speaker recognition software, is for the duration to be over 16 seconds with SNR at least 10dB.

Voice disguise

Voice disguise is one of the most important issues in FSR. It is normal that the culprits always try to disguise their voice while speaking through some communication devices. Also at the time of speaker verification, the suspected speakers may not cooperate well leading to voice disguise. In dealing with voice disguise, high complications arise. This is because, there are wide varieties of

types of voice disguise (both electronic and non electronic) and each type of disguise changes the voice features in a different way. So it is important to first identify whether a speech sample is disguised or not and if disguised classify the type of disguise. Only then reliable recognition of speaker can be done are some recent works in voice disguise. Channel and environment mismatch is yet another headache to tackle with in Forensic Speaker Recognition. Normally it is difficult to recreate the evidence scenario due to reasons such as the unavailability of the handsets or lack of information about the channel type etc. The state-of-the-art methods to test the intersession problem are linear discriminant analysis (LDA), nuisance attribute projection (NAP) and within-class covariance normalization (WCCN). System developed with Relative Spectra (RASTA) processing on MFCC, feature warping on MFCC and NAP on GMM super vector minimized the effects of channels. Still combination methods are found to

be more effective. In some widely employed speech crimes like mobile communication based crimes, combined distortions like disguise, channel effects, codec effects, noise etc. are quiet common.

The real cases in forensic scenario may have to deal with unexpected situations. In one such case, a near-far problem had to be handled. Here one speaker (B) who was speaking through a mobile phone was interrupted by another speaker (A) who was initially standing a short distance away and later came close to the first speaker. So the training data available was far for speaker A and near for speaker B. The problem was to identify the speaker of a section of speech after B moved close to A using these training data. This is anyway a very specific case and for each such case, the situations may vary. Yet another extreme case of complexity arises when a speaker has to be identified from a whispered speech segment. Does whispered speech has any role in forensics? Of course yes. Sometimes, the recordings may contain

such speech segments. Such conditions may arise. So it cannot be neglected. It is extremely difficult to identify a speaker based on his whisper. Recognition accuracy significantly reduces in whispered speech. Since there is no vocal cord vibration involved in whispered speech, there are significant acoustic differences from normal speech. A number of factors have to be considered while dealing with speaker identification using whispered speech. Changes in the characteristics of the voiced sounds (vowels and voiced consonants) are significant in whispered speech compared to the unvoiced sounds. Adaptation using a small amount of whispered speech improves the accuracy rate. Whispered speech can be used for speaker identification because it contains enough speaker information required for this. Fusion methods show better performance in all stages of speaker recognition. Also as far as forensic cases are considered, we cannot use a readymade system to identify a speaker. Instead; based on the situations

of the real caseworks, different robust methods should be combined and applied. Also in order to increase the accuracy of identification systems, methods should be developed to identify a speaker from short and frequently used sounds like humming. These methods should be independent of type of noise, environment and channel. Nowadays, as Voice over IP (VoIP) is becoming popular, its effect on speaker recognition is also to be considered in the design of FSR systems.

REFERENCES

1. Andrzej Drygajlo, "Forensic Automatic Speaker Recognition", IEEE Signal Processing Magazine, March 2007, pp. 132-135.

2. Furui, S, "Acoustic and Speech Engineering (OnkyoOnseiKougaku)", Kindai Kagakusha Publishing Company, Tokyo, 1992.

3. Zakariah, Mohammed, Muhammad Khurram Khan, and Hafiz Malik, "Digital multimedia audio forensics: past, present and future", Multimedia Tools and Applications, 2017, pp. 1-32.

4. Assembly of Behavioral, and Social Sciences (US), Committee on Evaluation of Sound Spectrograms, "On the theory and

practice of voice identification", vol. 4. National Academies, 1979.

5. Amino, Kanae, Takashi Osanai, Toshiaki Kamada, HisanoriMakinae, and Takayuki Arai, "Historical and Procedural Overview of Forensic Speaker Recognition as a Science", In Forensic speaker recognition, pp. 3-20, Springer New York, 2012.

6. Koenig, Bruce E, "Authentication of Forensic Audio Recordings", Journal of the Audio Engineering Society 38, no. 1/2, 1990, pp. 3-33.[7] Campbell, Joseph P., Wade Shen, William M. Campbell, Reva Schwartz, JeanFrancoisBonastre, and DrissMatrouf, "Forensic Speaker Recognition", IEEE Signal Processing Magazine 26, no. 2, 2009, pp. 95-103.

8. Joseph P. Campbell, "Speaker Recognition for Forensic Applications", Odyssey 2014, The Speaker and Language Recognition Workshop, Finland, June 16-19, 2014.

9. Stolcke, Elizabeth Shriberg Andreas, "The case for automatic higher-level features in forensic speaker recognition", 2008.

10. Reynolds, Douglas, Walter Andrews, Joseph Campbell, Jiri Navratil, Barbara Peskin, Andre Adami, Qin Jin et al, "The Super SID project: Exploiting High-Level Information for High-

Accuracy Speaker Recognition", In Acoustics, Speech, and Signal Processing, 2003, Proceedings, (ICASSP'03), 2003 IEEE International Conference on, vol. 4, 2003, pp. IV-784-IV-787.

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A person's fingerprint set is like a biological seal which, one impressed, can never be denied. - -Colin Beavan, on page 11 of his book "Fingerprints - The origins of crime detection and the murder case that launched forensic science",

FORENSIC TAPHONOMY

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Abstract

Various taphonomic processes are responsible for the changes in a carcass. At present, late postmortem changes such as bloating, blister formation, colliquative putrefaction (qualitative variables) are utilised for estimation of time since death / postmortem interval in cases of advanced putrefaction. Due to seasonal /

geographical variations there is gross difference of opinion in estimation of such postmortem intervals. These late postmortem changes can be converted to a scoring system (quantitative factors) called Total Body Score (TBS). A very recent concept called Accumulated Degree Days (ADD) measures temperature units accumulated into a carcass over a material time. TBS obtained is incorporated into ADD to estimate the postmortem interval more accurately.

1. Introduction

Taphonomy is the study of laws of burial (Tafo – burial and nomos – laws). It was originally developed in paleontology to reason out why animals became extinct or fossilised and got preserved. More specifically, taphonomy is the study of the processes related to decomposition, disposal, erosion, burial and exposure of organisms before, at and after death. Under taphonomy archaeological, anthropological, entomological,

geological and botanical factors cause differential preservation of some species, individuals or body parts over others.

Forensic taphonomy is a subfield of forensic science that examines various taphonomic forces which alter the material evidence in a medico-legal investigation. In the forensic context, it is of utmost importance to reconstruct perimortem and postmortem events, to discriminate natural trauma from human induced trauma. There are two branches of forensic taphonomy:

a) Biotaphonomy: This is concerned with examination of the human remains to find out how decomposition of the hard and soft tissues was brought about. There are three categories of biotaphonomic variables:

I. Environmental factors / external variables: It includes biotic (animals etc.) and abiotic (climatic) factors

II. Individual factors: These are factors pertaining to the dead body such as the body size, age at death, etc.

III. Cultural / behavioural factors: These are human activities such as embalming, autopsy procedures, assailant induced trauma, etc.

b) Geotaphonomy: This is concerned with burial of the bodies and includes:

I. Disturbance of soil including compaction, aeration, mixing etc.

II. Production of tool marks in the walls of burial grounds.

III. Production of footprints at the bottom of grave.

IV. Disruption (acceleration or retardation) of plant growth and subsoil root patterns.

V. Alterations of natural water drainage and erosion patterns.

VI. Alterations of surrounding soil pH.

2. Taphonomic processes and weathering patterns

2.1 Taphonomic processes

The most important taphonomic processes are environmental variables under biotaphonomy.

a) Abiotic / climatic: It includes rock fall, seepage of water, volcanic shockwaves, invasion by roots of trees, etc. Temperature is a very important factor since chemical and biological changes of decomposition are regulated by this one.

b) Biotic / animals: Animals, rodents, insects, maggots and bacteria destroy human remains. Many fine striations, trough, grooves and depressions are seen on bones similar to those produced by human artifacts. Trampling has been emphasised as of great importance in taphonomic bone changes due to disarticulation and alteration of human remains. This is because trampling marks can mimic cut marks. From the forensic point of view, it is important to distinguish true cuts on the

bones from cut marks due to trampling. Animal chewing also represents an obvious and well-known taphonomic factor since different patterns of bone alteration due to animal chewing are observed. The pattern of chewing varies for different bones. Often animal chewing produces spiral fractures that have been misinterpreted as an evidence of human activity.

Though it is difficult to interpret such fractures, caution has to be exercised while arriving at the conclusion of such human remains.

2.2 Weathering patterns

In taphonomic processes, weathering represents the response of a bone to its immediate environment like soil, sun etc. as opposed to carnivore modifications, trampling and geochemical changes. Weathering pattern can help in ruling out perimortem trauma and to some extent can assist in understanding and reconstructing the PMI. Research so far is conducted on bones of recent mammals and hence the time interval in human

cases will be a little shorter. There are six progressive stages of bone weathering:

Stage 0: Bone is greasy. No signs of cracking or flaking.

Stage 1: Fat, skin, and tissues are lost. Bone shows cracking - parallel to fibre structure (longitudinal in long bones).

Stage 2: Outermost concentric thin layers of bone show flaking.

Stage3: Bone surface is characterised by patches of rough homogeneously weathered compact bone. Gradually patches cover the entire bone.

Stage 4: Weathering penetrates into inner cavities.

Stage 5: Bone is falling apart in-situ. Original shape of bone is difficult to determine.

3. Applications / medico-legal importance of forensic taphonomy

Using data collected during field recovery and with laboratory analysis of the remains, the anthropologist generates a taphonomic profile that

describes and clarifies the perimortem and postmortem history of the human remains. In addition, this generated profile helps to assess the assailant's behaviour, any evidence of subsequent movement of the remains, predictions as to where additional remains may be located and regarding clarification of forces that produced scattering of the remains.

3.1 Estimation of postmortem interval (PMI) / time since death (TSD)

Forensic pathologists may receive bodies in advanced stages of decomposition, where other available methods for establishing TSD like algor mortis; rigor mortis etc. are no longer reliable. Numerous studies have been conducted on both humans and non-human remains to determine PMI. Majority of these studies are qualitative in nature enabling only a wide time interval. Moreover, qualitative studies produce data of PMI that may not be standardised or repeatable due to changes in seasons or climates of different geographical

regions. Whereas, the quantitative methods can provide more accurate and shorter PMIs applicable to varying geographical regions / seasons.

3.1.1 Qualitative research on PMI

Opinion as to the PMI is almost always subjective. Interpretation of data varies depending upon experience and knowledge of the experts along with climatic variations. Hence, attempts were done to divide the progress of decomposition into stages. Vass et al. divided decomposition into two major stages namely ***pre-skeletonisation*** and ***post-skeletonisation***. ***Pre-skeletonisation*** was subdivided into four stages: fresh, bloated, decay and dry. Galloway added the fifth stage known as extreme decomposition. ***Post-skeletonisation*** includes changes affecting the dry bones, which are grouped together under weathering. The differences in above mentioned stages are largely

due to variations in the decomposition process brought about by the differences in the environment.

In 2004, Bass and Jefferson demonstrated the famous case of Colonel William Shy, which is a typical example related to the difficulty in estimating TSD. Bass had to examine the remains of a human body in a grave. The remains had excellent soft tissue preservation as well as namely burial, sealed iron coffin and embalming fluid clothing. The cause of death was opined as gun-shot wound to the head and TSD was approximately one year. Few weeks later, the tombstone of the grave was detected referring the remains to a person named Colonel William Shy who had died 113 years prior to the discovery. This large underestimation was because of a combination of external biotaphonomic variables.

3.1.2 Quantitative research on PMI

Haskell et al had discovered that other disciplines such as forensic entomology and botany

make use of quantitative methods to estimate PMI. Vass et al made an attempt to bring in applicability of soil studies to estimate PMI. Megyesi et al came up with Accumulated Degree Days (ADD). ADD are heat energy units which represent accumulation of thermal energy needed for chemical and biological reactions to take place in a dead body during decomposition. Such temperature units are used to quantify the rate of decomposition. To calculate ADD, the maximum and minimum temperatures of the day at that particular location / site of discovery of remains are averaged to produce the mean daily temperature.

Megyesi et al incorporated both qualitative and quantitative data to estimate PMI, which involves the conversion of the qualitative data (stages of decomposition) into quantitative scores from three different regions of the body namely head and neck, trunk and limbs. They made an objective scoring pattern with allotted point values for these three regions (Tables 1 to 3). These

points are added together to obtain the total body score (TBS). Hence, TBS is the decomposition stage expressed in terms of quantitative score that can be used in statistical calculation.

Megyesi et al concluded that approximately 80% of variation in decomposition is due to ADD and decomposition should be modeled as dependent on accumulated temperature rather than the elapsed time. A longitudinal study of quantitative variables, TBS and ADD can be done by plotting the TBS of decomposed carcasses against known PMIs. This is followed by estimating ADD from plotted values, thereby developing a formula to calculate the ADD. The following formula was developed by Meygesi et al:

$$ADD = 10(0.002xTBSxTBS+1.81) \pm 388.16$$

Table 1: Scoring pattern for decomposition of the head and neck

Stages of decomposition	Scores
Fresh, no discolouration	1 pt
Pink-white appearance with skin slippage and	2 pts
Gray to green discolouration: some flesh still	3 pts
Discolouration and / or brownish shades particularly at edges: drying of nose, ears,	4 pts
Purging of putrefied fluids out of eyes, ears, nose, mouth; some bloating of the neck	5pts
Brown to black discolouration of flesh	6 pts
Caving in of the flesh and tissues of the eyes	7 pts
Moist decomposition with bone exposure less than one half that of the area being scored	8 pts
Mummification with bone exposure less than one half that of the area being scored	9 pts
Bone exposure of more than half of the area being scored with greasy substances and	10 pts
Bone exposure of more than half the area	11 pts
Bones largely dry, but retaining some grease	12 pts
Dry bone	13 pts

If TBS can be calculated by examining the remains, then ADD can be estimated with ease. The investigator needs to obtain the average daily

temperatures of the preceding days. The investigator must count backwards from the day of discovery of remains until accumulated sum equals estimated ADD. Statistically speaking confidence intervals of roughly 95% can be calculated, which seems to make this method accurate and reliable.

For example, if TBS is 28 then:

ADD = 10(0.002x28x28+1.81) ± 388.16

= 2387.81± 388.16

= 1999.65 to 2775.97 days ºF

The correction factor of 388.16 is required due to variations in the microclimates between the site of death and weather station. With the ADD obtained, TSD is estimated by removing the daily average temperature day by day until ADD becomes zero. This would give an estimate as to the zeroth day when the body had started decomposing in that area. Suppose 65 ºF is the approximate daily average temperature for previous days, then PMI is:

ADD = 1999.65 to 2775.97 days ºF.

Substitute 65 ºF in the obtained ADD.

PMI = 1999.65/65 to 2775.97/65 days

= 31 to 43 days

According to several studies, based on this principle the dataset fell within 80% confidence intervals.

Table 2: Scoring pattern for decomposition of the trunk.

Stages of decomposition	Scores
Fresh, no discolouration	1 pt
Pink-white appearance with skin slippage and marbling present	2 pts
Gray to green discolouration: some flesh relatively fresh	3 pts
Bloating with green discolouration and purging of putrefied fluids	4 pts

Post bloating following release of the abdominal gases, with discolouration changing from green to black	5 pts
Decomposition of tissue producing sagging of flesh; caving in of the abdominal cavity	6 pts
Moist decomposition with bone exposure less than one half that of the area being scored	7 pts
Mummification with bone exposure of less than one half of the area being scored	8 pts
Bones with decomposed tissue, sometimes with body fluids and grease still present	9 pts
Bones with desiccated or mummified tissue covering less than one half of the area being scored	10 pts
Bones largely dry, but retaining some grease	11 pts
Dry bone	12 pts

It has been established confidently that this method of TSD estimation can be used in regions with cold climate and low humidity. Pigs were used for most of the studies since they are similar to humans in the internal anatomy, intestinal flora, fat to muscle ratio and in general hairlessness of the skin. The reliability of ADD along with TBS is yet to be proved in the climatic scenarios of India and South East Asia. Moreover, this method is only suitable on carcasses lying exposed on surface and not in cases of buried or drowned bodies.

3.2 Environmental reconstruction / reconstruction of postmortem events

The taphonomic indicators obtained from the site of discovery and from the remains of human carcass are of great potential significance in reconstruction of events. Barnacles adhering to bones indicate exposure to sea water. In bodies obtained from moist soil areas, green algae stains may be frequently present. If the orifices of a body are embedded with soil it mostly indicates previous

burial. Soil filled bones with exposure to sun are expected in remains obtained from an undisturbed grave in a sunny area. Bleaching of bone surface usually indicates prolonged sun exposure. At times salt water can also produce similar findings. They are dependent on the level of chemicals in soft tissues. At times cobwebs are seen in skulls recovered from abandoned garages.

Other than environment affecting the remains, the dead body or the assailant also modify the immediate environment in contact with them. The decay of the carcasses affects the microenvironment of the grave by altering soil consistency, plant growth and insect infestation. The physical characteristics of the terrain / soil will be altered when an assailant digs a grave. At times by careful examination of the terrain the assailant's behaviour can be assessed in one direction or another.

Table 3: Scoring pattern for decomposition of the limbs.

Stages of decomposition	Scores
Fresh, no discolouration	1 pt
Pink-white appearance with skin slippage of hands and / or feet	2 pts
Gray to green discolouration; marbling; some flesh still relatively fresh	3 pts
Discolouration and / or brownish shades particularly at edges; drying of fingers, toes, and other projecting extremities	4 pts
Brown to black discolouration, skin having a leathery appearance	5 pts
Moist decomposition with bone exposure less than one half that of the area being scored	6 pts
Mummification with bone exposure of less than one half that of the area being scored	7 pts
Bone exposure over one half of area being scored, some decomposed tissue and body	8 pts

fluids remaining

Bones largely dry, but retaining some grease	9 pts
Dry bone	10 pts

3.3 Locating a grave or unknown burial ground and exhumation

Both public as well as crime investigators have difficulty in locating the unmarked graves. Unmarked graves are formed when there was no deliberately laid out border or covering or a marker like headstone. They can be formed accidently when bodies get buried or trapped under soil. The crime investigators will be interested to know the basic principles of locating a grave, to identify the hidden grave of a crime victim and to exhume it for further investigations. Basically there are three main groups of survey techniques that can be chosen depending on condition of the site of suspected unknown grave.

3.3.1 Surface survey techniques

The topographic survey method requires detailed measurement of the land surface using precise survey equipment such as differential global positioning system. The team must include someone who can use this equipment effectively as well as an archaeologist, geomorphologist or landscape architect who can accurately read and interpret the form of land surface. The surface depressions or mounds will be defined by marking with nails or stakes.

The botanical survey technique can significantly enhance results of a topographical survey. A very close examination of ground surface will help to identify the location of flowering bulbs, distinct colonies of diverse plant growth and unusual densities within the distribution of a single species. Success depends on a range of factors including land use history, season in which it is undertaken and general climate in the area.

3.3.2 Archaeological techniques

Surface scraping is the common method. The grass and topsoil are removed systematically to reveal the surface of underlying subsoil. When a grave is dug, the soil is dumped in the surrounding ground surface. As the sub surface layers of the earth varies in texture, colour and other physical properties, the dugout earth will also show these properties.

3.3.3 Geophysical techniques

Ground magnetic surveys have been used for many years and recent technological developments have improved data collection and data quality. This technique relies on making exact measurements of the magnetic field of the earth. The different layers of soil contain varying amounts of magnetic particles like iron or magnetic minerals. When the layers of soil are disturbed or altered, the earth's magnetic field is also distorted. This disruption of magnetic field can be measured by a magnetometer.

Ground penetrating radar (GPR) has been used with great success in all kinds of shallow sub-surface investigations. It is relatively a new technique where radio-waves detect underground variations in soil structure and content, to be transformed into a three dimensional image on computer. The data will be different between naturally layered soil and mixed soil. GPR may have improved resolution in the detection of skeletal remains or wooden coffins. Excessively wet soil and breaks present in between the layers of soil can interfere with the reading obtained.

Electromagnetic surveys (EM) are used for detecting a range of magnetic sources in the ground beginning from simple metal detectors. An electric current passed through a wire coil at the surface produces a magnetic field that penetrates the earth. Where it encounters conductive material magnetic and electric fields are further created, which can be detected at the surface.

Resistivity survey is a method very similar to EM technique. Electrodes are inserted in the ground and electric current is pumped through them. Surface electrodes are then used to take measurements of voltage between points. Depending on the resistance of subsurface, voltage will vary. Thus, it is likely to map graves if they are more resistant than surrounding soil. This is possible since graves are drier than surrounding soil. Hence, wet graves can be a hindrance to this method.

3.3.4 Other survey techniques

Digitally enhanced topographic imaging is a newer improvised method. It is more effective than the ordinary topographic imaging because of the proper digital image improvement. Aerial photographic imaging is useful to obtain survey data from the air. If a large area is of interest to the researcher then aerial photography is the tool of choice. Seismic method relies on tracing vibrations in the ground. They are particularly

useful to explore deep underground features. Self-potential method relies on measuring naturally occurring electric currents in the ground. While in some cases there might be current variations due to changes in ground water conditions, one would not generally expect noticeable variations over old grave sites. Radiometric techniques detect presence of elements which have naturally occurring radioactive isotopes. The most common of these is potassium. Electro kinetic surveying is a recently developed method for measuring ground permeability. Digging can disturb this permeability in case of wet graves. Gravity measurements can be utilised to pick out subtle differences in the density beneath the soil surface. This is more useful in recent graves because in older ones the chances of cavities remaining will be very less. Cadaver scent dogs can be used to confirm whether human remains are actually buried in a particular site. These dogs are specially trained to identify the smell of decomposed bodies.

3.4 Distinguishing evidence of foul play from other taphonomic factors

The sum of forces acting on human remains should be seen as an outcome of interactions between the environment, the individuals / assailants preparing the burial and the remains themselves. Taphonomic observations must be interpreted by forensic anthropologists to distinguish natural forces from manmade or external factors. At times weathering cracks can resemble those produced by blunt force trauma. Spiral fractures produced by trampling or carnival chewing are similar to those caused by foul-play associated trauma. Fungal growth causes blackening of bones that simulate burning. The tooth marks produced by animals can be similar to sharp force trauma. Following case studies in the published literature indicate the significance of forensic taphonomy.

3.4.1 Skeleton and the shotgun

Mann and Owsley in 1992 describe a case in which a skeleton was discovered in a farmer's field along with a shotgun. Skeletal analysis revealed cranial fragmentation along with numerous small perforations in the pelvic area. Though not all cranial fragments were present, those present were multicoloured in appearance. The variability in colouration (due to several taphonomic factors like sunlight exposure etc.) suggested that breakage occurred during early postmortem period. All these along with presence of gunshot residues suggested a perimortem close range shot. But, the small round perforations in the pelvic area turned out to be postmortem injuries. The perforations were located on the head of the femur with no injury to corresponding area of the acetabulum clearly indicating that the femur and pelvis were not articulated when injury was sustained. Taphonomically small weathering cracks were present on the bones of the pelvis indicating postmortem exposure of 2-3 years. The

perforations of pellet had intersected the small cracks of weathering. This indicated that cracks had formed prior to the formation of perforations. Hence, it was proved that the skeleton was present in the field for a long time, that weathering cracks occurred and perforations in the pelvis were made later only. Hence, taphonomic observations helped to prove that one of the events of gunshot was postmortem in nature.

3.4.2 Lady in the cistern

In 1984 human remains were found in an unused cistern near a mid-western U.S. airport. The remains were identified by dental comparison as those of a young woman reported missing in 1975. She was last seen at an evening party at her friend's house. Authorities had found evidence of fire in the basement of this house. Hence, they suspected that she had been killed and attackers had attempted to burn the body before disposing it within the cistern. Their theory was strengthened by the presence of blackened distal femur. But

analysis revealed that the blackened area was produced by fungus growing within the damp dark cistern which was a postmortem phenomenon not related to foul play. Circular white patches were present on the top of the cranium. Initially it was thought to be acid application or acid destruction. But taphonomic evidences suggested that they were produced by sunlight beaming through perforations in the thick manhole cover above.

3.4.3 Doctor who fisted

An exhumation and study of the remains of Dr. Carl Austin Weiss was done in 1991. He was killed on 8th September 1935. There were lots of controversies around the manner of death. According to one of the theories there was an argument that Weiss had struck his opponent hard with his fist before being shot down and killed. Since it was a sensational case, taphonomists were entrusted to examine hand bones for evidence of trauma. Radiographs and visual examination revealed no apparent gross fractures. However,

microscopic examination revealed small fractures within metacarpals of the right hand raising the possibility that Weiss had sustained stress fractures of the metacarpal diaphysis. Additional analysis revealed similar small fractures on the diaphysis of the left hand metacarpals and on some metatarsals as well. It was proved beyond reasonable doubt that all micro fractures were as a result of postmortem taphonomic factors and not from perimortem trauma.

3.4.4 Bones from cemetery

In July 1991, a young woman was reported missing. Investigations revealed that she may have been abducted, killed and buried in a local cemetery. Later in September 1992, excavation of an unauthorised burial site recovered a number of bones possibly representing the victim. Analysis by the Department of Anthropology, Washington D.C. through FBI laboratories indicated that all bones are likely to be originated from one individual, a young to middle aged adult female. Though the

information was consistent with age and sex of the missing person, the extent of weathering indicated that the bones were from an old grave and not that of the recent missing person. Besides another interesting finding was the evidence of trauma to the thoracic vertebrae that was mistaken for perimortem trauma. This sharp forced trauma had lack of soil adhesion, lack of erosion of the exposed trabeculae and a distinct colouration pattern all of which indicated that it was a postmortem event. Later, it was concluded to be produced by a shovel during the exhumation process.

4. Conclusion

Taphonomy has a vital and unique place in the field of forensic science. While examining human remains, taphonomic factors are considered essential for estimation of TSD, reconstruction of postmortem events and for assessment of pseudo trauma. At present the studies on PMI estimation using ADD were done mostly on pigs in prospective aspects. The reliability and validity of ADD

estimation can be improved further if experiments or studies are done on human carcasses. This in turn can be helpful to the police officials and courts for medico legal investigations where TSD has become a moot point.

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REFERENCES

1. Nawrocki S. Taphonomic processes in historic cemeteries. In: Grauer AL, editor. Bodies of Evidence: Reconstructing History Through Skeletal Analysis. New York: John Wiley and Sons, 1995.p.49-66.

2. Marshall LG. Bone modification and "The Laws of Burial". In: Bonnichsen R, Sorg MH, editors. Bone Modification. Orono: Centre for the Study of the First Americans,1989.p.7-24.

3. Andrews P, Cook J. Natural Modifications to Bones in a Temperate Setting. Man 1985;20:675-691.

4. Sutcliffe AJ. Similarity of Bones and Antlers Gnawed by Deer to Human Artifacts. Nature 1971;246:428-430.

5. Haynes G. Evidence of Carnivore Gnawing on Pleistocene and Recent Mammalian Bones. Paleobiol 1980;6:341-351.

6. Behrensmeyer AK. Taphonomic and Ecological Information from Bone Weathering. Paleobiol 1978;4:150-162.

7. Vass AA, Bass WM, Wolt JD, Foss JE, Ammons JT. Time since death determinations of human cadavers using soil solution. J Forensic Sci 1992;37: 1236-1253.

8. Galloway A. The process of decomposition: A model from the Arizona-Sonoran Desert. In: Haglund WD, Sorg MH, editors. Forensic Taphonomy: The Postmortem Fate of Human Remains. Boca Raton: CRC Press, 1997.p.139-150.

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Dead body is extremely eloquent and honestly informative, if one exercises patience in listening to it.

SIGNIFICANCE OF COMMUNITY POLICING IN CRIME SCENE PROTECTION

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Janamaithri Suraksha Project is a prestigious programme of Kerala police launched by government of Kerala in 20 selected police stations in March 2008 to professionally strengthen the police and increase its accessibility to the needy public through interaction with and better understanding of the public, which soon made a tremendous impact on Kerala society. The process got further momentum by incorporating all police stations in Kerala and within no time it captured international acclaim. The programme provides the police a deep access to the public on all walks of life. More over the common people became

empowered to meet the police without fear especially in socially and communally sensitive situations. Highlighting the achievements of Kerala Police in this regard the Bureau of Police research and Development (BPR&D) and the Government of India has recommended this as a model programme which can be implemented in all the other states of India. The police - community partnership has contributed much to reduce crime level by training the citizens on strategic areas like anti-drug campaign, traffic training, riot control etc., and by ensuring timely flow of criminal related intelligence to police about strangers and other persons of doubtful character, persons who have committed a crime etc. It also guarantees people's participation in solving neighbourhood problems and ensuring communal harmony through collective efforts particularly during festivals, religious processions and public functions.

Community policing

Now that the concept of community policing is successfully approaching its target of associating citizens and reducing crime level, let the next step be the tapping of its still unused potential; that is educating the public about the necessity of crime scene protection for effective enforcement of justice to the hapless victims. As David Purdy, Senior Police Adviser, Department of State, United States, spoke during the Global Conclave on Community Policing in Kochi, on the need to make community policing an organic programme that should continuously change to meet emerging challenges, enforcing justice to victims of crime has now become a challenge and community policing can play a significant role to meet this challenge. In this modern era of science and technology conventional methods of investigation are not appreciated by courts and every steps should be scientific. So it is very critical to educate the public on the importance of scientific evidence and

inculcate civic sense in the mind of public for a successful conviction which is the ultimate intention of every law-abiding citizen.

It is evident from the past criminal cases that the conviction rate is very poor and many cases ended in acquittal due to the absence of proper evidence to link the criminal with the victim and the crime scene. The reason for this is the failure to submit substantiating scientific evidence before the honourable court. As Webster points out evidence is anything legally submitted before an honourable tribunal to ascertain the truth of any alleged matter of fact under investigation before it. It can be submitted in the form of testimonial evidence as the statement of witnesses and physical evidence which is actually scientific evidence, as the role of the physical evidence in the crime can be scientifically proved before the court of law. Testimonial evidence or the oral evidence given by eye witness has the twin defects that it can be a lie or it can die it the witness become

hostile and change his words during trial. The witness statement again may be wrong as a result of partnership, faulty memory or defective observation which can create confusion in the court of law. There are so many examples and we have a clear case in point before us in the sensational 'Soumya case' in the form of the severe complications created in the Honourable Supreme Court by the statement of the unknown middle aged man as expressed by the other two witnesses – "According to both the witnesses, they heard the sounds of a woman crying and wailing coming from the ladies compartment and though P.W. 4 wanted to pull the alarm chain of the train, he was dissuaded by a middle-aged man standing at the door of the compartment who reported to them that the issue should not be carried any further as the woman had alighted from the train and had made good her escape" (Ref: supreme Court Judgment on Soumya Case). Even though this was inconsistent with the investigation as the victim

was helpless and incapable of moving, the apex court reached to the conclusion that the accused cannot be held liable for injury of fall as "The circumstances appearing against the accused has to be weighed against the oral evidence on record and the conclusion that would follow must necessarily be the only possible conclusion admitting of no other possibility."

As far as scientific evidence is concerned, it is more reliable than eye witnesses to crimes as it is actual evidence and its presence is absolute proof of a crime. This evidence can never be a lie or never die and are the fully dependable silent witnesses to the crime. Again in cases of offences against women and children which occur in secluded and inaccessible places there may not be any eye witness. When a criminal commits a crime knowingly or unknowingly, certain materials are left behind at the crime scene or on the victim and the criminal will carry away certain materials from the

scene or victim, either on his body or clothing or weapons. The sum total of these constitutes physical clues or silent witness. This will appear in the form of a drop of blood, a few hairs, a fibre of his clothing, a mark left by his tool, or a glass he breaks or the soil left from his footwear or his fingerprint on an object of contact. They should be kept intact for a successful investigation to identify what happened and who is responsible for the incident.

At the crime scene

The first contact with the crime scene should be a cursory one, and extreme care should be exercised not to disturb the scene in any way. In many situations, it may be the public who enter the crime scene first before the arrival of the investigating officers or the Forensic team. Their ignorance may affect the evidence collection. They don't know what evidence is and what its importance is. Their presence may either be as a part of rescue operation or out of curiosity. Of

course priority should be given to save life; but they should avoid further search to satisfy their curiosity. The over enthusiastic public who enter the crime scene tamper the evidence out of ignorance in several occasions. In many cases blood stained footprints, fingerprints and hairs, found at the crime scene created much confusion to the investigating officers which had not actually belonged to the culprit. "Every contact leaves some trace" as suggested by Dr. Edmond Locard. It is possible to identify the criminal at molecular level using a rooted hair or a drop of blood or a trace of body fluid in the form of saliva on an abandoned cigarette butt by the criminal. Recently in a murder case with much strenuous efforts, the investigating officer could narrow down the suspect and he later confessed to the crime. But when the forensic examination result was released, DNA extracted from the nail clippings of the victim did not match with that of the accused. On the basis of it, the accused moved the honourable High Court alleging

that he had been wrongfully implicated by the investigating officer. There are so many similar cases and it would have been better to conduct a survey to see the fate of cases ended in acquittal due to the absence of scientific evidence, or the ones affected by its wrongful handling like addition of unwanted items or deletion of available clues.

DNA Technology

With the introduction of touch DNA technology as a new investigative tool, the items of evidence at the crime scene that can be used for DNA analysis has been dramatically increased. Every day thousands of exfoliated epithelial cells are shedding from our skin which can form a source of DNA on left over items. There are so many objects of contact left by the criminal at the crime scene like his abandoned clothing, gloves, kerchief, hat, footwear, tools used to gain entry, mobile phones, weapons, used vehicles etc., which bear his genetic signature in the form of cells.

Everything at the crime scene should be guarded and nothing should be touched. But if we use this advanced technique not only touching but also sneezing, coughing, or talking over at the crime scene can contaminate these vital evidence.

The screams of every victim for help will remain in the mind of the masses as an unhealed wound. Their gruesome pain is ours also. They might have been making desperate attempts to speak aloud the harrowing experiences that were undertaken by them. Their souls may have been making attempts in vain to say who was responsible for their plight; how they were been mercilessly dragged; how they were brutally attacked ; which was the weapon used, where it was dropped by the culprit and how heinously they had been abused by the cruel ones neglecting their repeated pleading for help . The victim is the only person who knows everything about the crime. They want to tell their sad story to the honourable

court, but they are helpless. Their unheard voice is the voice of the prosecution. If the investigating officer can narrate the incidents before the court with the same pain of the victims, they can do it only with the help of the silent witness at the crime scene which alone can argue for the unfortunate victims. It is our duty to ensure them justice availing such clues. Our experiences show that even in well planned and carefully meted out cases, a few unaccountable evidence either in the form of a fingerprint or hair will tamper the progress of investigation which may create unnecessary doubt and affect the successful enforcement of justice even if how meticulously the investigation was conducted. Therefore let the brave new step of Janamaithri Suraksha Project be in this direction so that the process of Law Enforcement will become far more effective by seeking the active co-operation of the public in performance of police duties.

Hence the necessity of scene of crime protection should be extended from the police officers to the public and they should be aware of what can be done in a crime scene to protect the evidence for a successful prosecution. The dos and don'ts to be followed by the investigating officers to protect the integrity of evidence should be taught to them to ensure maximum possible evidence. The help of Janamaithri Kendra's, Gramasabhas, and other such groups can be used to impart this knowledge to maximum members including People's Representatives, Kudumbasree units, College students, Village and Panchayat offices, Youth clubs, Residents associations etc. It is also appreciable to conduct a pilot study to assess their awareness regarding how to approach a crime scene at times of necessity and what precautions should be observed to prevent the loss of evidence so that justice can be ensured to the victim and maximum punishment can be imposed to the culprit.

The ability to swim is not an important correlate of drowning since most victims of drowning are able to swim.

-Michael S. Pollanen in his book "Forensic Diatomology and drowning", Elsevier,

AN UNENDING QUEST FOR TRUTH – A BACKUP FROM FORENSIC MEDICINE WITH RECENT UPDATES.

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INTRODUCTION

What, why, who, when, where? The 5 ringing questions clinging to the mind of an investigating officer with a crime file in his hand is the motivation behind this write-up. Forensic Medicine is an umbrella discipline covering many fields such as Forensic pathology(autopsy),toxicology,

pharmacology, serology, ballistic, explosive analysis, anthropology and odontology employing tools ranging from simple Microscopy to sophisticated analytical instruments to solve the mysteries of crime excluding or associating a suspect with the victim or scene of crime, ensuring the reliability and admissibility of scientific evidence in the court rule. The observation and analysis of physical evidence/ trace evidence from crime scene can be critical to solving many cases. Over the past decades many achievements were made in Forensic medicine with exciting advancements in technology available to Investigating officer and laboratory analyst and Forensic Experts. Many of the newer methods employed by the criminalists are based on years of scientific research that had rendered them extraordinary sensitive and specific to ensure thorough and effective crime scene analysis, orderly collection of evidences, correct interpretation and deduction.

TRACE EVIDENCE ANALYSIS

This includes any physical evidence, living or dead, solid, liquid or gas, which is related to the problems in the question. Physical evidences are useful in two ways. As a decisive factor in determining guilt or innocence or a linking factor between the suspect, weapon or scene of crime.

The famous Locard's principle of exchange is one of the basic theories of forensic sciences and trace evidence detection. It states that-Whenever two objects come into contact with each other there is a mutual transfer of materials from one material to the other.

Many scientific tests are available to detect the presence of biological materials for the confirming and even individualizing the samples. Routine use of ultra violet light can help in detecting stains of various origin such as blood, semen, pus, saliva, tissue milk, etc.

Test to detect blood or blood components

Luminol test: If Luminol is sprayed in crime scene and if blood is present in that area, it will glow in dark. Luminol is a 3-amino pthalylhydrazide. When it reacts with blood in the presence of an oxidant (H_2O_2). It forms a product which gives a blue glow in the dark which can be documented by photograph.

Benzidine test: have high sensitivity to minute traces of hemoglobin and its derivatives, but not specific for blood. The suspected stain is treated with glacial acetic acid, ether, hydrogen peroxide, and benzidine. Presence of blood is indicated by immediate blue colour.

Phenophthaline test: Blood stain reacts with phenolphthalein reagent in the presence of hydrogen peroxide and gives pink color immediately.

Most of the above mentioned tests are not specific test and may give a false positive result. Hence, the results should be confirmed by any of the following methods:

1. Crystal test
2. Spectrophotometry
3. Electrophoresis
4. Immunoelectrophoresis
5. Chromatography

Determination of species of origin from biological material -Precipitin test helps in determining the species origin i.e. whether the sample belongs to human or any other animal. Many other information that can be determined from blood statins are

- ✓ Source of blood
- ✓ Whether it is fetal blood.
- ✓ Blood of pregnancy and abortion.
- ✓ Menstrual blood

- ✓ Arterial and venous blood can be differentiated on the basis of amount of blood loss and spurting characteristic.
- ✓ Ante-mortem or post-mortem.
- ✓ Sex of the individual (by detecting Y chromosomes or Davidson bodies in white blood cells)
- ✓ Age of the blood stains (by colour changes by the help of Spectrophotometry or electrophoresis technique)

Test to detect semen and seminal stain

Various tests are available to detect presence of semen or seminal stains. These include:

Acid phosphatase Test: Test which is sufficiently specific and applicable to semen or seminal stains in normal as well as vasectomized individuals.

Barberio test, Florence test, etc. are other chemical tests to detect seminal stains.

A microscopic examination of seminal stains is usually used as a confirmatory test.

Immunological test like Prostate Specific Antigen test (P-30) and MHS-5 detection test are the other confirmatory tests available.

Individualization of Semen can be done by ABO grouping (similar to blood grouping), DNA finger printing, photonflurometry, and detection of androgens ratio (male sex hormones), etc. Grouping of seminal stains is possible only when the person concerned is a secretor.

Test to detect Salivary stains

Various modern techniques are available to detect salivary stain. This is possible by detecting the presence of various contents in saliva like amylase, thiocyanate, alkaline phosphatase etc. Individualization can be done by amylase isoenzyme analysis, ABO grouping, DNA analysis and red cell enzyme assay. Analysis of DNA have replaced all other old techniques in identification.

Other than above mentioned body fluids, any tissue parts like bone, muscle, hair etc. can be

used for identification of species and even individuals with appropriate scientific methods

Trace evidences or biological evidences that leaves tell-tale marks on crime scene, the analysis of which can reconstruct crimes, describe people and places and things involved in them.

DNA FINGER PRINTING

What is a DNA?

DNA or Deoxyribonucleic acid, carries genetic information in a genome which held within genes. It is referred as biological blue print as it is responsible for the physical features hair eye and skin color, height, facial features blood type and countless others.

DNA typing (DNA profiling or DNA fingerprinting) is a technique employed by forensic scientists of individuals by their respective DNA profiles. DNA profiles are encrypted sets of numbers that reflect a person's DNA makeup, which can also be used as the person's

identifier. DNA testing is the most accurate form of scientific evidence available within millionths of a percent! It's allowed the justice system to easily find the criminals. To identify individuals, forensic scientists scan DNA regions, or loci, that vary from person to person and use the data to create a DNA profile of that individual (sometimes called a DNA fingerprint). There is an extremely small chance that another person has the same DNA profile for a particular set of 13 regions.

The beginning

DNA Typing or DNA profiling was first described in 1985 by an English geneticist, Alec Jeffreys. Dr. Jeffreys found that the structure of DNA could differ from individual to individual. By developing a technique to examine the length variation of these DNA, Dr. Jeffreys created the ability to perform human identity cases.

DNA's detective story

IN 1985 a Ghanaian boy, who had arrived in Britain to join his mother on what looked like a forged passport, was in danger of being deported. The family's lawyer asked Alec Jeffreys, a geneticist at Leicester University, if there were any way to establish maternity genetically. A few months earlier, Dr. Jeffreys had identified regions in the human genome that differed from person to person which, he reckoned, could be used in parentage testing and forensic analysis. Trying out his theory, Dr. Jeffreys compared the mother's DNA with that of the disputed son, as well as with her other children. The result made history. The family's DNA fingerprints not only showed that the boy was indeed her son, but also that all her children shared the same father. The Home Office dropped the case, and the boy was allowed to stay.

DNA was first used to aid a criminal investigation by Professor Jeffreys in 1986

On 21 November 1983, a 15-year-old girl named Lynda Mann left her home to visit a friend's

house. She did not return. The next morning, she was found raped and strangled on a deserted footpath. Using forensic science techniques available at the time, police linked a semen sample taken from her body to a person with type A blood and an enzyme profile that matched only 10 percent of males. With no other leads or evidence, the case was left open.

On 31 July 1986, another 15-year-old girl, Dawn Ashworth, took a shortcut instead of taking her normal route home. Two days later, her body was found in a wooded area near a foot path called Ten Pound Lane. She had been beaten, savagely raped and strangled to death. The modus operandi matched that of the first attack, and semen samples revealed the same blood type.

The prime suspect was Richard Buckland, a local 17-year-old youth with learning difficulties, who revealed knowledge of Ashworth's body, and admitted the crime under questioning, but denied the first murder.

Investigating officers approached Dr. Alec Jeffrey for his newer technique, Jeffrey's compared semen samples from both murder and proved that both girls were killed by the same man, but not Buckland. Buckland became the first person to have his innocence established by DNA fingerprinting. Investigating agency then undertook an investigation in which more than 5,500 local men were asked to volunteer blood or saliva samples. This took six months, and no matches were found.

On 1 August 1987, one of Pitchfork's colleagues at the bakery, Ian Kelly, revealed to fellow workers in a Leicester pub that he had obtained money for giving a sample while masquerading as Pitchfork. Pitchfork told Kelly that he could not give blood under his own name because he had already given blood while pretending to be a friend of his who had wanted to avoid being harassed by police because of a

youthful conviction for burglary. A woman who overheard the conversation reported it to police.

On 19 September 1987, Pitchfork was arrested. During subsequent questioning, Pitchfork admitted to exposing himself to more than 1,000 women, a compulsion that he had started in his early teens. He later progressed to sexual assault and then to strangling his victims in order to protect his identity. He pleaded guilty to the two rape/murders in addition to another incident of sexual assault, and was sentenced to life imprisonment. The Lord Chief Justice at the time of his sentencing said: "From the point of view of the safety of the public I doubt if he should ever be released. The Secretary of State set a minimum term of 30 years; in 2009, Pitchfork's sentence was reduced on appeal to 28 years.

On 29 April 2016, the Parole Board announced that Pitchfork's petition for parole had been denied, but they then issued a recommendation that Pitchfork be moved to an

open prison. In June 2016, Pitchfork was moved to an undisclosed open prison. The Parole Board may again consider his release in 2018.

The scientific basis of DNA typing

DNA profiling uses repetitive sequences that vary from person to person. Chromosomal region with short tandem repeating DNA units (STRs) have been used as a marker for human identification in forensic cases. Multiple copies of mitochondrial DNA are present per human cell. Because of this mitochondrial DNA analysis is the method of choice when dealing with environmentally challenged samples, E.g. Identification of victims in mass disaster, exhumed human remains.

Fabricated DNA

Scientists in Israel at a company called Nucleix found that it is possible to fabricate DNA evidence. They showed that if they have a DNA profile they can use it to create a sample of DNA

that matches that profile, without actually obtaining tissue from the person. Fabricated DNA can have serious consequences. To counteract this problem police should ensure that DNA is not only evidence used in future.

POLYGRAPH TEST

Polygraph test otherwise known as lie detector is an instrument which records various body responses like variations in BP, pulse, respiration, breathing rhythm, body temperature, and skin conductivity, when the subject is asked and answers a certain question related to crime, on the theory that false answers will produce body changes that gives distinctive measurements. In simple words polygraph records psychological changes during questioning.

Reliability of polygraph test: Studies show that polygraph accuracy is 80-95%. Polygraph test result is not acceptable in many countries in the world including India.

VOICE STRESS ANALYSIS (VOICE RISK ANALYSIS)

It is a technique that compares pitch, frequency, intensity and micro tremors in the voice of a person. Voice analysis detects variations in the voice which may signal lying. Many companies in banking and insurance sector are using this method during telephonic conversation with their customers to assess the truth in certain situations. Some studies have suggested that voice stress analysis technology is better than poly graph test in detecting emotional stress.

NARCO ANALYSIS

It also known as truth serum or drug hypnosis or narco interview technique. In this technique experts infuse certain chemicals (e.g. Sodium Pentothal) under the medical supervision. These drugs can lower subject's inhibition and hypnotize him hoping that he will freely share the information and feelings. But studies have shown that it is possible to lie under narco analysis and if

the person is drug addict, process will not be as successful as expected. The principle of criminal justice system is that person giving information should be well and fit but in narco analysis test person is in a semiconscious stage.

BRAIN FINGER PRINTING

It is a method Invented by Lawrence Farewell. This technique determines whether specific information is stored brain by measuring electrical brain waves response to word, phrases, picture etc. by this technique it is assured that information stored in EEG can be revealed by specific pattern in EEG. By comparing various patterns in the EEG the system mathematically compute weather information present (person knows some facts about the crime) or information absent (person does not know the information).Brain finger printing has been applied in number of high profile cases in western countries.

BRAIN ELECTRICAL OSCILLATION SIGNATURE PROFILING

It is developed by an Indian Neuro Scientist Dr. Mukundan in 2003 for extracting an electro physiological impulse.

It is a non-invasive (doesn't need administration of any drug) technique with great degree of sensitivity. It is based on the theory that when brain of an individual is activated by a piece of information of an event in which he/she has been taken part primarily, the brain will respond differently from that of a person who has received the same information from a secondary source. This technique could help distinguish false memory from real one.

FUNCTIONAL MAGNETIC RESONANCE IMAGING (FMRI)

It is a type of specialized MRI scan that measures responses from brain cells and spinal cord. It is one of the most recently developed form

of neuro imaging, with very low exposure to radiation and wildly available. In this technique brain activity is measured by detecting changes associated with blood flow in brain vessels. This technique based on the fact that cerebral blood flow and activity of nerve cells of brain are well related. FMRI dominates brain mapping in all aspects. This technology is in its early stage of development

ODONTOLOGY

Forensic odontology is the application of dental science to legal investigations, primarily involving the identification of the offender by comparing dental records to a bite mark left on the victim or at the scene, or identification of human remains based on dental records.

Forensic odontology has much to offer in the detection and solution of crime or in civil proceedings. Most often the role of the Forensic odeontologist is to establish a person's identity. Teeth, with their physiologic variations, diseases

and effects of therapy, record information that remains throughout life and beyond. The teeth may also be used as weapons and, under certain circumstances, may leave information about the identity of the biter.

VIRTOPSY (Virtual autopsy)

An autopsy (postmortem examination,) is a highly specialized surgical procedure that consists of a thorough examination of a corpse to determine the cause and manner of death and to evaluate any disease or injury that may be present. Virtopsy is a word combining 'virtual' and 'autopsy' and use imaging methods that are also used in clinical medicine such as computed tomography (CT), magnetic resonance imaging (MRI), etc., for the purpose of autopsy and to find the cause of the death. Virtopsy can be employed as an alternative to standard autopsies for broad and systemic examination of the whole body as it is less time consuming, aids better diagnosis, and renders respect to religious sentiments. Virtopsy is quickly

gaining importance in the field of medico-legal cases, but still has its own disadvantages. This technique has been recently used by forensic odontologists, but yet to receive its own limelight.

CONCLUSION:

Even though the first finger print bureau of the world is established in India, we are still not utilizing many of the newer forensic techniques which might have thrown light in many unsolved cases. Awareness, availability and accessibility are the confronting factors that should be encountered and bridged. With all these modern techniques in hand, no crime is an unsolved mystery to an eminent investigating team. The people changes, circumstances changes, but the quest for truth should go on.

REFERENCE

1. Crime scene processing and investigation Christine R Ramirez

2. Forensic Science Advances and their Application in the Judiciary System. Danielle Sapse And Lawrence Kobilinsky

3. Textbook of Forensic Medicine and Toxicology. Dr. V VPillai

4. Text Book of Forensic Medicine and Toxicology. Dr. KrishanVij.

5. Essentials of Forensic Medicine and Toxicology. K.S. Narayan Reddy.

6. Recent advances in Forensic Medicine. Dr. Gautam Biswas.

7. Individual-specific 'fingerprints' of human DNA AJ Jeffreys, V Wilson, SLThein - Nature, 1985 – Springer

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In Forensic Medicine, eye the most, hand the next and tongue the least.

-(From the front page of Practical Notebook on Forensic Medicine prescribed for undergraduate students at the Department of Forensic Medicine, Al-Ameen Medical College, Bijapur, India).

FALSE POSITIVITY OF ALCOHOL IN TOXICOLOGICAL ANALYSIS

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Ethyl alcohol, commonly found in alcoholic beverages, is one of the most frequently detected drug by toxicology laboratories and is the leading cause of death due to associated diseases and social violence. It acutely impairs human body functions and produces neurophysiologic changes at advancing stages of intoxication. The

metabolism (*all the chemical processes in your body, especially those cause food to be used for energy and growth*) of Ethanol is subjected to multiple variables. Toxicologists have quantified ethanol in virtually all bodily organs, tissues, and secretions. Blood from the femoral or subclavian veins is the "gold standard "for analysis of ethanol in medicolegal death investigation. But, in certain cases, where there is no history of alcoholism, the body may mysteriously show positive results to the presence of alcohol. The person might not have touched alcohol during his entire lifetime. This peculiar phenomenon is hard to explain and may pose a stumbling block in arriving conclusions. Some of the scientifically proven reasons behind this include the following.

1.Putrefaction

Postmortem decomposition spuriously increases blood Ethanol due to endogenous production by overgrowth of normal, fermentative flora in the gut.

2. In embalmed bodies

The constituents of embalming fluid in case of embalmed bodies may lead to false positive results for alcohol.

3.Through Food or Medicine

Alcohol may inadvertently enter the body by consumption of medicines like cough syrups, certain Ayurveda medicine, etc., certain fruit juices, beverages, etc.

4. Decrease in alcohol dehydrogenase level

In certain individuals there may be a genetic defect that may lead in decrease in alcohol dehydrogenase levels, which is an enzyme involved in metabolism of Alcohol.

5. Gender

Bio availability (the proportion of a drug or a chemical which enters to the blood circulation when introduced in to the body and is so able to have an active effect) of alcohol is grater in women than in men. This inherent changes lead to alcohol even in

minute amounts staying longer in body, un-metabolized.

6. Contamination of sample

We should also think of contamination of samples during collection, dispatch and examination in laboratory unknowingly or may be sometimes, knowingly.

7. Contamination of instrument and containers

Contamination of instrument and containers which is used for collection, dispatch and detection procedures.

These possibilities have to be born in mind while dealing with a case of unsuspected alcoholism to avoid turning into wrong directions. To a certain level, these can be overcome by the following tests. We have to analyze vitreous humor, a fluid inside eyeball which is a reliable comparison medium to differentiate ante mortem consumption from

postmortem production. Characteristic gross and histological pathology in various organ systems such as liver, pancreas and brain may be diagnostic of chronic alcoholism even without a known history. These estimations depends not only on the timing of collected specimens, but also on factors such as the individual's physiology, the type of alcoholic beverage consumed, and the length and circumstances of the drinking period. Recently researchers have focused on developing various biochemical test or markers of postmortem synthesis of alcohol. In present situation, properly recognized, obtained, packaged, transmitted, analyzed, and stored specimens yield results that are valid for expert interpretation in the court of law.

Forensic Science is the link between the criminal and the crime.

- Ken Goddard, Wildlife Forensics, (quoted in Nature (German) Nov

PATTERN OF INJURIES TO RULE OUT SUICIDE: A CASE REPORT

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ABSTRACT

Examination of Gunshot wounds helps to discern the type of weapon used. It also helps in perceiving the distance from which shot was fired. In this case, a rich man fond of hunting and always assisted by an accomplice went for hunting as usual. The accomplice didn't return home the next day. The rich man was found absconding. Body of the aide was found in the forest with a gun by his side. Examination of injuries ascertained that the shot was fired from a distance and can never be suicidal.

INTRODUCTION

The study of firearms and ammunition is called ballistics.

Internal ballistics: Signifies study of motion of projectile within the firearm

External ballistics: Connotes the study of motion of projectile on a target.

Terminal ballistics: Means the study of effect of the projectile on a target.

Doctors and investigation officers should possess basic knowledge in terminal ballistics.

Firearms are generally of two types; smooth bored and rifled, depending on the nature of the barrel. When the inside of the barrel is smooth, it is called smooth bored. When a barrel is cut into a number of longitudinal spiral grooves it is called a rifled weapon. Rifles, revolvers, pistols, machine guns are all rifled weapons. Rifling gives spinning movement to bullet thereby increasing its stability and penetrating power. Shotguns and country

made guns are smooth bored. In Developing Countries, weapons and ammunitions may be homemade. These are common in India where the name country gun is well understood.[3]

Forensic examination can assess whether the weapon is smooth bored or rifled, the nature of the projectiles, the nature of the propellant, the range of discharge and angle of discharge. This can help in deciphering the manner of death.

CASE REPORT

Body of an adult male was brought for autopsy with history of firearm injury. A country made firearm was recovered from near his body. He had accompanied a rich person for hunting the previous night. His body was found after a search on his no return after hunting. The other person was absconding.

Whole body x-rays were taken. Multiple opacities of pellets were seen in x-rays of skull, neck, chest and both upper limbs.

On autopsy a total of 69 entry wounds were present, on face, front of neck, front of chest and front of both upper limbs. No exit wounds were present.

A total of 45 metallic pellets were recovered from body. These included 2 each from right and left chest cavities, 4 from right lung, 3 from left lung, and 2 from left ventricle. Pericardial cavity and chest cavities contained fluid blood and blood clots.

Maximum dispersion of pellets were 41 cm in the vertical axis and 40 cm in the horizontal axis.

DISCUSSION

In rifles the projectile is bullet, and the pellets are the projectiles in shot guns. Multiple pellets are present in a shot gun cartridge and are released in a single shot. So in the present case a smooth bored firearm or shotgun must be the weapon used. Hence the country made firearm

found beside the body could be the weapon used which should be confirmed by ballistic expert.

In shotgun injury, the doctor need not recover every pellet present. A few pellets should be recovered for the ballistic expert to determine the shot size and possibly type of weapon.

In shot gun injuries the pellets enter the body as a single mass producing a round hole up to about 2 metres.

By 2 metres the pellets begin to spread. A shot from a distance of 2 metres produces a large hole with a few small individual pellet entrance holes surrounding it. This type of entrance wound is called a rat hole.

As distance increases, the central hole will reduce in size with more and more individual pellet holes dispersed around.

Over 4 metres, the dispersion of pellets will be complete and there will not be any central hole.

So in the present case the shot was a distant shot – from more than 4 metres. This being a country made firearm will not strictly adhere to the above said ranges. Actual range has to be given by a ballistic expert after test firing. But the shot in this case is unequivocally from a distant range and hence not suicidal. Accidental or homicidal should be answered by Police investigation.

REFERENCES

1. Umadethan.B. Firearm and explosion Injuries. Principles and Practice of Forensic Medicine. 1st ed.Swamy Law Publishers, Kochi;2008 p 192.

2. Karmakar.R.N. Firearm Injuries. J.B. Mukherjees Forensic Medicine and Toxicology. 3rded.Academic Publishers, Kolkata; 2007 p 384.

3. Saukko.P, Knight.B. Gunshot and explosion deaths. Knights Forensic Pathology. 3rd ed. Arnold Publishers, London;2004 p 248.

4. Ignatius.P.C. Gunshot wounds and explosion wounds. Forensic Medicine and Toxicology.1sted p147,155.

5. Narayan Reddy, Murty O P. Mechanicalinjuries. The essentials of forensic medicine and Toxicology.23rded. The health Sciences Publishers, New Delhi; 2014 p.134.

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In a sense, the victim shapes and moulds the criminal.
- Hans von Hentig

MEDICAL CRIMINALISTICS

Dr. Arul R.B.Krishna IPS

Introduction

Medical criminalistics involves the clinical examination of victims and suspects, the inspection of the scene of crime with subsequent medico-legal autopsies, the assessment of biological evidences from the spot and the reconstruction of criminal events in a medical angle. The sole aim of medical criminalistics is to supplement the investigation

process and improve the techniques necessary for the elucidation of crime and for ensuring adequate evidential value. The word "criminalistics" is defined by the California Association of Criminalists, as the profession and scientific discipline directed toward the recognition, identification, individualization and evaluation of physical evidence by application of the natural sciences to law-science matters.

Even though legal/forensic medicine is a university subject in most countries, criminalistics is slowly emerging as a field of sub speciality within Forensic Sciences. Traditionally, legal medicine also covers many fields of activities belonging to Forensic Sciences. Apart from its academic tasks, legal medicine also utilise ‘‘the application of medical knowledge in the administration of justice’’. Legal medicine and criminalistics are closely related because both are oriented towards forensic needs. Criminalistics specifically include the steps essential for the reconstruction of the course of events and legally relevant facts under medical aspects,

especially interpretation of findings in suspicious deaths, inspection of the scene and assessment of biological stains. No matter how advanced the medico-legal work is, the reconstruction of events has always been a challenging task. Contrary to forensic autopsies the main scope of which is not so much to determine the cause of death as such, but to clarify legally relevant circumstances and contexts (determination of the approximate time of death, differentiation between self-inflicted injuries and lesions caused by another person, analysis of wound findings with regard to the object used, recognition and interpretation of trace material, etc.), Medical criminalistics has a specific feature for reconstructing the event from scratch. The evaluation of gunshot wounds as to number and localization of hits, line of fire, firing range, weapon and ammunition used, self-infliction or involvement of another party, effect on the capability to act, etc. is an example how the purpose of an investigation

goes beyond purely medical findings to criminalistic and juridic questions of evidence.

Medical criminalistics need extensive research so as to evolve as an independent branch. Some study designs, which play an important role in medical and therapeutic research (controlled, randomised clinical studies, cohort studies, case–control studies), are not suited for medical criminalistics because the forensic material is completely different. Other study types are better used for the specific circumstances in forensic medicine, for example, prospective cross-sectional studies, retrospective observation studies and case reports. In those areas in which laboratory techniques are to be utilised for the recording of new parameters or the optimisation of existing procedures, validation of the methods is of special significance. For medical criminalistics, case reports play a major role in understanding the complexities. Multiple queries arising in the mind of an investigator cannot be answered by experience

alone, but require experimental research. Experiments performed on appropriate test models to clarify the biomechanical basis of injury formation are an example. Without proper research activities, legal medicine and thus, medical criminalistics would rapidly fall behind the pace of quick evolving modern day science.

From the large number of criminalistically relevant questions, which can only be clarified by systematic medicolegal investigations, a few examples from the field of gunshot injuries would enlighten the practical aspect of it. Composite models of pig skin and gelatin blocks have been used to demonstrate the gunshot-related transfer of skin particles along the bullet path and the transport of microorganisms from the entrance and exit region into the wound channel. Various studies deal with typical and atypical entrance/exit wound localizations in suicides and homicides. The view often taken in suicidal cases of gunshot is that the victim almost regularly uncovers their chest before

firing a shot to the heart. The question of a victim's ability to act is particularly important for reconstruction purposes. It has been shown that immediate incapacitation is to be expected only if central nervous structures essential to physical activity are affected. Thus, multiple gunshot suicides are possible if the first shot did not injure a target of immediate incapacitation. Also, it is not necessary that a weapon found in the hand of the deceased speaks against a suicide if there are special circumstances explaining this finding. Yet another phenomenon of criminalistic importance is biological ''backspatter'' and its possible deposition on the accused depending on the shooting distance.

Clinical forensic medicine is subject to time-related changes which have to be described and analysed on the basis of the current evaluation material. This is true for sexual offences, forensic psychopathology, child abuse, domestic violence, torture, injuries from traffic accidents, bodily harm, attempted homicide and self-inflicted injuries. The

simulation of criminal offences has now become a challenging topic with many different categories and manifestations. In standard practices of injury evaluation, such as stab and cut wounds, new questions may be raised concerning the specificity of wound patterns indicating either a knife attack by another person or self- infliction. Thus, a cut on the palmar side of a hand does not always mean a defence wound, as it can also be self-inflicted unintentionally by the offender when the knife is vigorously thrust and hits a solid resistance so that the hand slides from the hilt onto the blade . In contrast to majority of the autopsy studies, there is no predominance of defence injuries on the left forearm and hand, when looking at surviving victims of sharp force . The significance of findings associated with survived and fatal strangulation is another area of interest. In such cases, congestive petechial haemorrhages do not constitute a specific sign of asphyxia as they may occur during physiological processes of pressing or any force

also. It is clear that apart from the examples given above, a multitude of further forensically relevant questions have to be solved on the basis of indisputable evidence which requires assistance of Medical criminalistics.

For an efficient interpretation of morphological findings, it is extremely important to train the ‘‘diagnostic eye’’ of the expert. Visual memory often sets the course of the analysis of an individual case, even if additional examinations using technical equipment and the application of natural sciences are needed. Despite the wide variability of phenomena and external circumstances, medical criminalistics is frequently faced with stereotypic patterns of findings, which derive from archetypal modes of behaviour in the commission of crimes and suicides. For these reasons, it is highly advisable to publish instructive photographic material of general importance in the form of an atlas. An interesting tool for discrimination between homicides and suicides was

presented by Karlsson who used multivariate projective statistical models in sharp force fatalities and in deaths from firearms. By analysing a great number of solved forensic cases, he created a model to find out predictive criteria whether a certain fatality shows similarities to homicide or suicide [Ref: T.Karlsson, Multivariate analysis, Forensionetrics]. Afterwards, the statistic model was validated on new sets of authentic cases. This approach has high sensitivity and specifity regarding its ability to identify homicides. The predicting variables are ranked according to their covariation with homicide or suicide. Other mathematical models can help to simulate the optical properties of human skin to identify the status of haemoglobin and to recognize carbon monoxide poisoning by means of reflection spectrometry. An autopsy register as a central database which covers all rare events, such as intoxications with plant or animal toxins recorded in one place, can become a source for scientific

corroboration. The project of a national forensic autopsy register has been successfully initiated in Germany and the scientific activities coordinated by a committee operating under the roof of the German Society of Legal Medicine.

In contrast to other medical disciplines, it is found that in forensic medicine new findings are first described within a case report. Case reports have an important role in forensic literature. By describing individual observations, new injury patterns and causes can be presented. Some forms of physical child abuse, generally known today, such as shaken-baby syndrome, battered-child syndrome etc were described in the scientific literature only some decades ago, although they probably existed long before. Until recently, many reputed representatives of medical criminalistics wrote a large part of their scientific work in the form of case reports. The ‘‘Archives of Criminology’’ probably the oldest still existing scientific journal of its kind, is a good example for a platform which

provides the tradition of bringing together specialists of different forensic sciences. Solving complex criminal cases often requires interdisciplinary cooperation. If fatalities are concerned, participation of medical criminalistics is unavoidable. Case reports on methods of homicide, which are rare or leave no external traces do not only help to reveal the original course of events, but underline the necessity of careful autopsy considering all diagnostic alternatives. This applies, for example, to deaths where the body is found suspended: as there are plenty of case reports on homicides by hanging and the simulation of suicide by hanging a victim previously killed or made unable to resist.

The future prospects of medical criminalistics solely depend on the clear focus on research by medico legal institutes. It is clear that this branch of science will add to the scientific armamentarium for elucidation of crime and high evidentiary valued

results, hence supply latest medical knowledge to the administration of justice.

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Forensic medicine is like an illegitimate child of health and home departments. We belong to both, but none belong to us. We offer our services to both, we are answerable to both, but we receive nothing from either. I feel that it is high time that our paternity be ascertained and we be adopted by our rightful parentage.

-Professor L. Fimate on the occasion of XXII Annual Conference of The Indian Academy Of Forensic Medicine, Jaipur, India.

TOUCH DNA TECHNOLOGY

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Abstract

DNA has undoubtedly been a breakthrough for modern criminal investigation. Touch DNA refers to the DNA that is left behind from skin cells when a person touches or comes in to contact with an item. However, the touch DNA is invisible to the naked eye and usually deposited in smaller amounts than the DNA found in bloodstain or other body fluids and it is more difficult to

identify areas where skin cells may be present. Obtaining successful touch DNA results depends on recognising items which may be suitable for touch DNA analysis, proper collection/storage of these items and the subsequent use of the optimal sampling technique that will recover the lightest number of skin cells. In crimes where identification of the suspect has proved to be a potential challenge for investigators, the touch DNA has been an effective tool. The present work throws light on the importance of touch DNA in criminal detection.

Introduction

Touch DNA technology has given detectives a kind of molecular witness in many cases that may have otherwise remained unsolved. The latest re-evaluation involves Touch DNA- the invisible genetic markers we leave everywhere we go, and on virtually everything we come into contact with. Touch DNA is a forensic method for analysing DNA left at the scene of crime. It is called 'Touch DNA' because it only requires very small samples. For example; from the skin cells left on an object after it has been touched or casually handled. Touch DNA analysis only requires seven or eight cells

from the outermost layer of human skin. By the late 1990s, Restriction Fragment Length Polymorphism(RFLP) was being replaced by the Polymerase Chain Reaction (PCR) based Short Tandem Repeat (STR) DNA typing method. A new era of trace DNA detection had begun. The quantity of DNA required for analysis had been dramatically reduced. What was once a visible bloodstain had now become a speck of blood barely visible to the naked eye. As STR testing continued in to the new millennium, DNA profiles were beginning to be developed from evidence where there was seemingly no bloodstain or other body fluid present. This trace or 'Touch' DNA as it is now referred to lead to many questions. What had changed? How can we test evidence for skin cells? Will the results be meaningful or probative to the case? How do we process a crime scene and collect evidence? Is touch DNA really a different technology? Various touch DNA sampling techniques have been used at the crime scene in Forensic Laboratories worldwide for over a decade. The aim of this article is to high light the available sampling methods, provides recommendations for the collection of potential touch DNA items at the crime scene and to

familiarise the touch DNA technology to detect the culprit.

Why are DNA labs receiving more touch DNA requests?

Violent crime cases with no blood or semen are being submitted to DNA labs in the hope that touch DNA testing many provide investigative leads.

Why are labs seeing more success with touch DNA cases?

Evidence collectors have more training in recognising suitable items potentially handled by a suspect and how to collect touch evidence. DNA typing kits have improved in sensitivity and the number of loci detected, and instrumentation has improved in the areas of extraction, quantisation and instrumental analysis.

What makes it likely that a suspect may leave his touch DNA on an item?

Some suspects are known to shed cells more than others. It is known that we shed approximately 4,00,000 cells daily. The clothing worn by suspects reduce the number of cells that can slough off and

deposit themselves on a surface capable of producing DNA results. Suspects are nervous and tend to perspire more during the crime, leaving more cells behind. A suspect may touch his face or head and transfer a large number of cells to his hands or gloves. Also the rougher the surface texture, the higher the probability of abrading skin cells. Stronger contact pressure applied to the item also increases that probability.

Practical Application

Touch DNA has expanded the types of items that can be considered physical evidence. Everything from gun and knife handles, to steering wheels, basically any physical object the suspect touched can be used to try to develop a DNA profile.

Secondary transfer

Touch DNA can be transferred by a handshake from one person to another, then to an object like a knife or a gun.

Contamination issues

Contamination is a crucial issue in the analysis and interpretation of trace DNA. This technique has been criticised for high rates of false positives due to

contamination-for example, finger print brushes used by crime scene investigators can transfer trace amounts of skin cells from one surface to another, leading to inaccurate results. Because of the risk of false positives, it is more often used by the defence to help exclude a suspect rather than the prosecution. The chance of DNA profiles from two different people having the same genetic signature is vanishingly small.

Methods and common rules to help minimize contamination at the crime scene.

- Improve sample collection targeting
- Apply cell separation techniques to mixed samples prior to DNA extraction.
- Limit access to the crime scene.
- Do not talk over the evidence.
- Change gloves frequently after handling evidence.
- Do not touch areas on evidence that may be sampled for DNA.
- Use disposable fingerprint brushes and powder.
- Collect elimination samples from those who have been in contact with the evidence or scene
- Clean each crime scene tool coming into contact with evidence.

Methodology of Touch DNA Technology.

1. Targeting & collecting Methodologies

An important task of forensic investigator is to identify target surfaces which may contain traces of suspect DNA. The first step in collecting trace samples is to identify which areas to target. Most samples are collected using swabs. Swabbing an area requires a moistened swab to transfers the whole target area multiple times with some pressure and rotation of the swab so that the full surface area of the swab can contribute the collection.

2. Isolation of touch DNA

Silica based extraction, organic extraction, chelex extraction methods are used for the isolation of touch DNA. The newer method of isolation is silica based extraction which makes use of silica coated magnetic beads to capture DNA from the lysed cell.

3. Trace DNA quantisation

Dot blot techniques, capillary electrophoresis, quantitative PCR assay, yield gel technique are used for determination of quality and quantity of DNA in the trace samples.

4. Trace DNA Amplification

As touch DNA is available in trace amounts, the DNA is amplified to produce multiple copies by Polymerase Chain Reaction which are then assessed for length polymorphism and sequence polymorphism.

5. Trace DNA detection

Fluorescent tags are added to the DNA sample. These tags bind with the specific nucleotide sequences at the STR loci and help in detection of the loci.

Case Studies

Several cases have been solved using DNA technology. David Camm was accused of murder of his family. Touch DNA was introduced in the Third trial of David Camm by the defence. The DNA profile of another man Charles Bony was found on a number of objects at the crime scene. The Touch DNA evidence aided in David Camm'saquittal (Kircher-2013)

Touch DNA on the clothing worn by 6 year old John Bennet Ramsey at the time of her murder was identified and a full DNA profile was developed. The case tripped up authorities for over a decade. It can provide information that leads to a killer- or at least exonerates the innocent.

Rape solved: In 2008, the Maryland State Police Lab had a private lab re-examine the clothes of a 12year old girl who was raped in 1996. The lab retrieved a full DNA profile of the rapist's skin cells - a man who was already incarcerated for another rape he committed in 1996 with the touch DNA evidence, the 51 year old rapist was ultimately convicted for this second rape.

Touch DNA Technology in India

The use of touch DNA technology has been seen most extensively in the foreign countries in the recent past. But now touch DNA has taken a lead in India too. As India does not have a DNA data base, cases can be solved using touch DNA evidence only if suspects are available. This technology is being extensively used by the National Investigative Agency to catch hold of the terrorists in bomb blast cases.

Bodhgaya blast case

The NIA was able to crack the Bodhgaya blast case using touch DNA technology. In this case the bomber was disguised as a monk. Touch DNA recovered from his clothes could took the investigator to the perpetrator.

Sheena Bora, an executive working in Mumbai went missing on April 24, 2012. In August 2015, the victim's mother and step father were arrested for abducting and killing her and burning her corpse. In this case CBI has planned to use touch DNA technique to find the culprit.

Limitations

Touch DNA sampling methods and downstream DNA processing procedures are very sensitive. Hence there is greater chance of contamination. The investigator may also be faced with the challenge of determining what it means if unexplaining DNA is obtained. Also items that are likely to have been touched by many people such as a public pay phone or store counter are usually not good sources for probative or interpretable touch DNA profiles.

Conclusion

Touch DNA technology has a great potential in crime investigation. It helps in solving many cold cases which were closed due to the lack of proper evidence. Touch DNA also known as contact trace DNA has become a powerful tool in solving potential crimes like murder, sexual assault etc. Today both older cases and

current cases are taking advantage of this innovative technology. Through improvements on sampling methods coupled with increasingly sensitive DNA testing methods and through continual education of criminal justice community regarding in the testing possibilities, touch DNA is enabling forensic scientists to provide information in cases which were once unsolvable.

REFERENCES

1.Willimson AL 2012. Touch DNA:Forensic Collection and Application to Investigations. J Assoc Crime Scene Reconstr.,18(1);1-5.

2.Pramodkumar. Sheena Bora Case: CBI to use 'Touch DNA'(internet). The Asia Age; October, 2015. Available from http://www.asianage.com/India/Sheena-bora-case-cbi-use-touch-dna-752.

3.Kircher, Travis (8 October 2013) ''David Camm Blog: Dr.Richard Eikelenboom and his Touch DNA''. WDRB.

4.Joe Minor. Touch DNA: From the crime scene to Crime Laboratory(internet) Forensic Magazine 2013

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POST-MORTEM FORENSIC NEUROIMAGING V/S AUTOPSY IN TRAUMATIC BRAIN INJURY CASES.

Odysseus bent his knees and sturdy arms, exhausted by his struggle with the sea. All his flesh was swollen and streams of brine gushed from his mouth and nostrils. Winded and speechless he lay there too weak to stir, overwhelmed by his terrible fatigue.

-The Odyessey, Calypso (Book V), Homer (Quoted in the Preface in "Forensic Diatomology and Drowning" by Michael S. Pollanen)

Dr. Arul R.B. Krishna I.P.S.

Neurotraumatology and neuropathology play a significant role in forensic medicine. This is reflected in the statistics that show traumatic head and brain injury to be the cause of death or severe disablement in thousands of persons each year. Traumatic head and brain injuries are especially common in young children and the elderly, and are primarily the result of motor vehicle accidents, work or sport accidents, and falls in the elderly. There is a need for reliable investigation methods in the forensic examination of these manifold cases. The gold standard for the post-mortem forensic assessment of such cases is the forensic autopsy including histological examination. Main advantage of this method include direct information by inspection and the possibility of taking tissue specimens. But, the limitation of autopsy is that it is subjective and observer-dependent, and cannot be used to provide a second opinion in court

due to the fact that the body tissues are cut and cannot be stored for a longer time except for selected parts or small specimens for histological examination.

Radiological imaging methods like MRI and CT are increasingly being used in the field of forensic medicine, thereby providing a non-invasive investigation approach and an unlimited storage of the imaging data. This would also facilitate second opinions in the course of legal proceedings contrary to the autopsy. They play an ever-increasing role in post-mortem forensic neuro traumatology, and limitations of these imaging methods will have to be evaluated concerning the possibility of the detection, interpretation and visualization of forensically relevant findings.

Multi Slice CT (MSCT) and MRI are widely used for post mortem neuro imaging as a means of academic research. CT and MRI are almost equivalent in the evaluation of extra-axial hemorrhages which are found in RTA cases whereas in subdural and subarachnoid haemorrhages, sensitivity of neuro imaging is less compared to the forensic autopsy. The radiological methods were sufficient in the evaluation of

coupe or contre-coupe lesions during autopsy. It has to be noted that findings smaller than 3 mm regularly escape the radiologist's analysis. MR and CT imaging show a high sensitivity in the detection of hemorrhages in the white matter. MRI is superior to CT in identifying the lacerations in the brain tissue and brainstem injuries whereas the majority of dura mater ruptures are not seen using imaging methods. The classical forensic signs of increased brain pressure (e.g., flattened gyri, protrusion of the cerebellar tonsils) mostly escape the MSCT or MRI evaluation even though the overall specificity for edema and increased brain pressure are high. With regard to the size of infarction, imaging techniques are more specific but the initial stages of such infarct are better realised by autopsy. advanced decomposition is a challenge for forensic autopsy to delineate area of infarct or other finding where the imaging techniques show better sensitivity. Gaseous embolism is also found detected in MSCT.

Imaging-based reconstruction of the impact axis or the sequence of events is helpful in investigation and is generally superior to autopsy especially in view of its feasibility and the visibility of the traumatic findings. CT

and MRI reveals case-relevant information without the need of performing time-consuming bone maceration techniques and provides an excellent two - or three - dimensional overview. It takes about 30 second to generate a 3D skull reconstruction, and up to about 10min when special cuts in MSCT are applied. Another forensically relevant issue is the differentiation of hematoma caused by direct traumatic impact versus ‘‘indirect’’ fracture hematoma which will be significant for an investigator in finding out the original cause of death. In clinical forensic medicine, imaging offers the only possibility to obtain a non-invasive insight into the cranium. The forensic examiner is thus occasionally confronted with plain radiographs or CT and MRI data when it comes to investigate neurotraumatological findings in cases of living persons. Neuroradiological evaluation in forensic medicine is based on numerous clinical imaging studies, which have been performed on living patients over many years; In accordance with recent studies, the extensive clinical experience with CT and MR imaging can be transferred to postmortem situations and serve as a basis for post-mortem diagnostics, as there is no relevant difference between

the radiological appearances of most findings in ante- or postmortem brains in the first days after death.

CT and MR imaging seem to have a realistic potential to become useful adjuncts to forensic autopsy in future neurotraumatologic examinations.

The forensic potential is obvious when it comes to the evaluation of findings such as gunshot-induced injuries or complex skull fracture systems, where forensic reconstruction is highly essential. These findings are rarely mentioned in the autopsy protocols and hence seldom get relevance in the course of investigation. Furthermore, imaging reveals maxilla and mandible fractures which are not usually documented in the autopsies and are again a main indicator of physical struggle before death. Facial tissues are not dissected in the routine autopsy process due to ethical reasons and hence facial bone fractures can easily escape the autopsy evaluation especially if they are not accompanied by externally visible deformation or crepitation. Therefore, radiology methods have a prospect of becoming the new ‘‘golden standard’’, rather than the autopsy.

All is not well with imaging techniques as there is scope of further improvements which can increase the sensitivity of forensic-radiological analysis. Allowing the radiologists to have more expertise about forensically relevant findings and using standardized autopsy and imaging protocols as a basis for the comparison of both will help to have a co-ordinated view of the cases and provide platform for a prolific interdisciplinary knowledge transfer. Future studies in this field are expected to broaden the horizon of the Post mortem neuro imaging in crime investigation.

FORENSIC EVIDENCE AND CRIME SCENE INVESTIGATION

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Introduction

The most important part of any crime investigation is a detailed examination of the crime scene. Contemporary law enforcement has greatly expanded its ability to solve crimes by the adoption of crime scene investigation techniques. Recognition of physical

evidence is a vital step in the process. If potential physical evidence is not recognized, collected or properly preserved and tested, the forensic value of the evidence may be greatly reduced or even lost forever. Numerous routine and high profile cases have demonstrated the harsh reality that despite the availability of current crime scene technologies, specialized equipment, and sophisticated forensic laboratory analysis, the effective utilization of physical evidence in crime solving is only as good as the knowledge and integrity of the crime scene investigator

ANTHROPOMETRY

Alphonse Bertillon (1853-1914) - Bertillon devised the first system used to identify a person. In 1879 he developed the science of anthropometry - a systematic procedure in which a series of body measurements are used as a means of distinguishing an individual from another. For two decades it was considered one of the most accurate methods for personal identification, but it was eventually replaced by fingerprinting in the 1900's. But for his efforts, Bertillon is known as the father of criminal identification.

(Forensic Medicine doctor and investigating officer) and the objective legal system that supports those functions.

A crime scene may be defined as any place where an offence has been committed and physical evidence related to the offence can be gathered. Crime scenes can be classified based upon the size of the evidence into macroscopic and microscopic. The definition of crime scene should never establish immovable boundaries. The crime scene investigator must be constantly evaluating and frequently changing the defined area called crime scene.

Scientific Examination of a Crime Scene

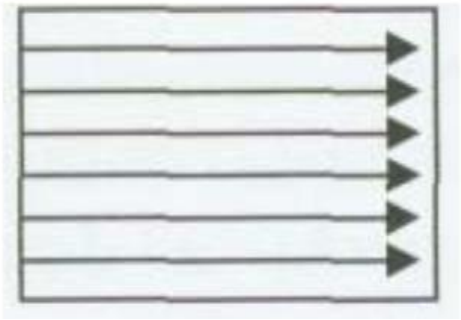
Scientific crime scene investigation is a process that involves:

1. Scene security –There should be proper security of the crime scene with no tampering or destruction of the evidence with the crime scene barricaded. The first responders at a crime scene are usually the police officers and their actions provide the basis for the successful resolution of the investigation

2. Scene documentation – Scene documentation starts with the preliminary survey which records the condition of the scene as it was first found. This can be done by a narrative description or by administrative notes. The crime scene can also be documented by sketching/diagramming or photography

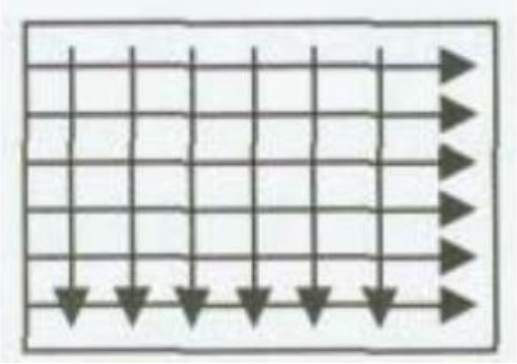
3. Scene search method/pattern - The preliminary crime scene search is an initial search for physical evidence present at the crime scene. It is an attempt to note obvious items of evidence and it is done for orientation purposes. There are various methods for searching a crime scene.

a) Link Method



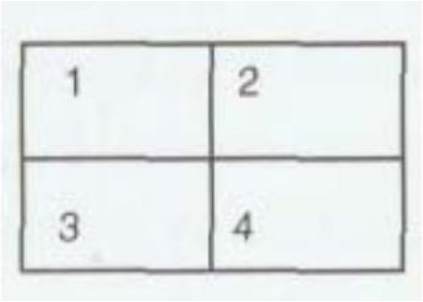
Most common and productive type, one type of evidence leads to another. Works in both indoor and outdoor scenes.

b) Grid Method



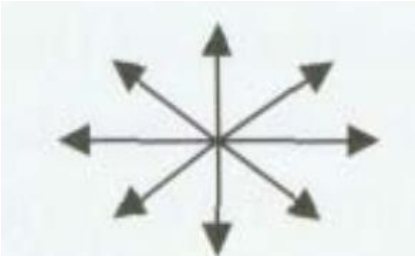
It is a modified version of the link method. It is extremely effective, but it is time consuming.

c) Zone Method



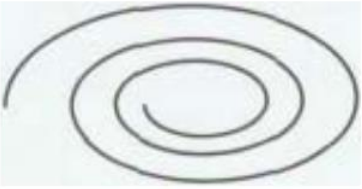
It is best used in scenes with defined zones or areas (houses or buildings). It is good for warrant searches.

d) Wheel / Ray Method



It is used in special situations such as in small circular crime scenes

e) Spiral method



It is best used in crime scenes with no physical barriers such as open water etc.

4. Scene evidences – Physical evidences (recognition, collection, preservation & examination) like blood, saliva, semen, paint, hairs, fibres, clothing, ammunition

can be collected by handpicking, tape-lifting, swabbing, sweeping and vaccuming. Each item should be packed separately to prevent cross contamination. It should be sealed, dated and sent for the analysis.

5. Scene reconstruction – It's a process of determining the events that occurred at the crime scene by analysis of crime scene appearance, locations, physical evidence and the forensic examination of the physical evidence.

Conclusion

Scientific crime scene investigation is the best methodology to ensure that an investigation is properly conducted and justice is served. Use of this methodology will prevent the abrupt end of an incomplete investigation and standardization of crime scene investigations.

References

1. McGraw-Hill, New York. Di Maio, V. (1999), Gunshot Wounds: Practical Aspects of Firearms, Ballistics, and Forensic Techniques

2. Joseph L. Peterson, John P. Ryan, Pauline J Houlden, Steven ihajlovic (1986) Forensic Science and the Courts: The Uses and Effects of Scientific Evidence in Criminal Case Processing, NCJRS Reports. U.S. Department of Justice, Washington, DC.

3. Dr.V V Pillay. Textbook of Forensic Medicine & Toxicology

Documents on Policing

KERALA POLICE PLAN STATEMENT

FOR IMPLEMENTINGAND INTERNALISING

THE COMMUNITY POLICING STRATEGY

Mission Statement:

The Kerala Police is committed to develop partnership between the public and the police so as to ensure safety and security in Kerala to the best possible extent and also prevent crime without affecting the rights of citizens, at the same time upholding the human rights of each citizen (as envisaged in section 3 of Kerala Police Act). We are dedicated to serve and protect and will continue to strive for strong Community relationship while providing a safe environment and thereby enhance the quality of life of the people.

MOTTO:- Kerala Police is committed to People Police Partnership for Security.

Our Vision Statement:

The Kerala Police shall develop a trusting working relationship based on mutual trust and respect with the Community so that each and every citizen and our visitors enjoy the highest possible quality of life strengthened by a sense of meaningful and democratic security.

Our Operational Strategy:-

1. Leadership

· The leadership will be committed to the philosophy of Community Policing and will formulate Community Policing goals as core Policing strategy.

· The leadership is committed to provide technological and financial aids for the Community oriented activities.

· The leadership will encourage all it's members to become leaders within the sphere of work of each and will adopt policies which inculcate and encourage problem solving and decision making capabilities among all officers.

The District Police Chiefs will be responsible to encourage subordinates to be creative with problem solving techniques and implement the projects taking responsibility for the physical and operational aspects of the project.

· The Inspectors and SDPOs will be responsible for ensuing house visits and arranging regular training programmes for the Community members and police personnel with the philosophy of Community Policing.

· Beat Officers, CROs and SHOs will be responsible to make house visits and meet regularly the Janamaithri Suraksha Samithi members.

· Community Policing will emerge as the core policing strategy.

2. Decentralization and Empowerment

Every Police Station area will be divided into Beats as envisaged in section 64 of the KIP Act. The Beat Officers will be in charge of their own small area and they will be empowered to forge partnership with the Community. The SHO will be responsible for extending the Operational support to the Beat Officers and CROs and thus implementing the project in partnership with the Community.

3. Community Empowerment

The community of citizens shall recognize that the security of the community can be improved by co-operating with the Police and citizens must come forward to work together with the Police in solving security problems. To facilitate this, programmes will be held by the Police to create awareness within the community and to instill confidence among the public regarding their role.

We will continuously and conscientiously strive to develop a positive relationship with the community, as envisaged in Section 63 of the Kerala Police Act.

We will scale up our efforts to forge partnerships with poor, downtrodden, Scheduled Caste & Scheduled Tribes communities for ensuring their safety and security and shall bring about qualitative improvements in all walks of their lives.

INSTRUCTIONS TO CONTRIBUTORS

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The Community Police Research Centre, is a research arm of Kerala Police, fully funded by the Government of Kerala, which by establishing deep rooted collaborations with academia, and civil society, aims at breaking new ground, in developing cutting edge practices for Policing in democratic societies, particularly in the developing world.

The journal welcomes contributions in respect of theoretical and practitioner perspectives, empirical studies, critiques, brief write ups in respect of recent good practices in Democratic Policing, comparative studies, book reviews, cartoons, etc; that is of relevance to the policing world in developing and transitional societies. The journal particularly encourages contributions, in respect of current policing innovations, backed by rigorous quantitative analysis. Argumentative essays dwelling on the core thoughts in Police sciences are also welcome. The journal also publishes news of advances in democratic policing in Police forces across the world. Academic articles/ essays should ideally not exceed 6500 words, and practitioner notes should not exceed 1500 words. Contributors are also also requested to include an abstract of 100 words, as well

as a brief biography of not more than 50 words. Submissions may be made electronically to janamaithri.pol@kerala.gov.in, or janamaithri.journal@gmail.com or by regular mail to the Editors*, 'Janamaithri'- A Journal of Democratic Policing,* Community Policing Research Centre, Police Headquarters, Thiruvananthapuram, Kerala, India-695003.

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