Journal of Forensic Chemistry and Toxicology

Corresponding address
Red Flower Publication Pvt. Ltd.
48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I
Delhi - 110 091(India)
Phone: 91-11-22754205, 45796900, Fax: 91-11-22754205
E-mail: info@rfppl.co.in, Web:www.rfppl.co.in

Journal of Forensic Chemistry and Toxicology (JFCT) (pISSN : 2454-9363, eISSN: 2455-8311) is a peer-reviewed scholarly journal and aims to publish the most complete and reliable source of information on the discoveries and current developments in the mode of original articles, review articles, case reports, short communications, etc. in all areas of **Forensic Chemistry and Toxicology** and making them available online freely without any restrictions or any other subscriptions to researchers worldwide. Forensic chemistry is unique among chemical sciences in that its research, practice, and presentation must meet the needs of both the scientific and the legal communities. As such, forensic chemistry research is applied and derivative by nature and design, and it emphasizes metrology and validation. Forensic chemistry encompasses organic and inorganic analysis, toxicology, arson investigation, and serology. JFCT deals with Forensic Medicine, Forensic Science, Forensic Chemistry, Analytical Toxicology, Analytical Chemistry, DNA Fingerprinting, Sexual Medicine, Environment Medicine etc.

Subscription Information

Institutional (1 year) INR9500/USD742

PAYMENT METHOD

By cheque/Demand Draft:

Cheque should be in the name of **Red Flower Publication Pvt. Ltd**. payable at Delhi.

By Bank Transfer/TT:

Bank name: Bank of India

Swift Code: BKIDINBBDOS

Account Name: Red Flower Publication Pvt. Ltd.

Account Number: 604320110000467

Branch: Mayur Vihar Phase-I

Delhi – 110 091 (India)

Send all Orders to: **Red Flower Publication Pvt. Ltd.,** 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091, India, Phone: 91-11-22754205, 45796900, Fax: 91-11-22754205, E-mail: sales@rfppl.co.in, Website: www.rfppl.co.in.

Journal of Forensic Chemistry and Toxicology

July - December 2018
Volume 4 Number 2

Contents

Revised Rates for 2019 (Institutional)

Title of the Journal	Frequency	India(INR) Print Only	India(INR) Online Only	Outside India(USD) Print Only	Outside India(USD) Online Only
Community and Public Health Nursing	Triannual	5500	5000	430	391
Dermatology International	Semiannual	5500	5000	430	391
Gastroenterology International	Semiannual	6000	5500	469	430
Indian Journal of Agriculture Business	Semiannual	5500	5000	413	375
Indian Journal of Anatomy	Bi-monthly	8500	8000	664	625
Indian Journal of Ancient Medicine and Yoga	Quarterly	8000	7500	625	586
Indian Journal of Anesthesia and Analgesia	Monthly	7500	7000	586	547
Indian Journal of Biology	Semiannual	5500	5000	430	391
Indian Journal of Cancer Education and Research	Semiannual	9000	8500	703	664
Indian Journal of Communicable Diseases	Semiannual	8500	8000	664	625
Indian Journal of Dental Education	Quarterly	5500	5000	430	391
Indian Journal of Diabetes and Endocrinology	Semiannual	8000	7500	597	560
Indian Journal of Emergency Medicine	Bi-Monthly	12500	12000	977	938
Indian Journal of Forensic Medicine and Pathology	Quarterly	16000	15500	1250	1211
Indian Journal of Forensic Odontology	Semiannual	5500	5000	430	391
Indian Journal of Genetics and Molecular Research	Semiannual	7000	6500	547	508
Indian Journal of Hospital Administration	Semiannual	7000	6500	547	508
Indian Journal of Hospital Infection	Semiannual	12500	12000	938	901
Indian Journal of Law and Human Behavior	Tri-Annual	6000	5500	469	430
Indian Journal of Legal Medicine	Semiannual	8500	8000	607	550
Indian Journal of Library and Information Science	Triannual	9500	9000	742	703
Indian Journal of Maternal-Fetal & Neonatal Medicine	Tri-Annual	9500	9000	742	703
Indian Journal of Medical & Health Sciences	Semiannual	7000	6500	547	508
Indian Journal of Obstetrics and Gynecology	Bi-monthly	9500	9000	742	703
Indian Journal of Pathology: Research and Practice	Monthly	12000	11500	938	898
Indian Journal of Plant and Soil	Semiannual	6500	6000	508	469
Indian Journal of Preventive Medicine	Semiannual	7000	6500	547	508
Indian Journal of Research in Anthropology	Semiannual	12500	12000	977	938
Indian Journal of Surgical Nursing	Triannual	5500	5000	430	391
Indian Journal of Trauma and Emergency Pediatrics	Quarterly	9500	9000	742	703
Indian Journal of Waste Management	Semiannual	9500	8500	742	664
International Journal of Food, Nutrition & Dietetics	Triannual	5500	5000	430	391
International Journal of Neurology and Neurosurgery	Quarterly	10500	10000	820	781
International Journal of Pediatric Nursing	Triannual	5500	5000	430	391
International Journal of Political Science	Semiannual	6000	5500	450	413
International Journal of Practical Nursing	Triannual	5500	5000	430	391
International Physiology	Triannual	7500	7000	586	547
Journal of Animal Feed Science and Technology	Semiannual	7800	7300	609	570
Journal of Cardiovascular Medicine and Surgery	Quarterly	10000	9500	781	742
Journal of Forensic Chemistry and Toxicology	Semiannual	9500	9000	742	703
Journal of Global Medical Education and Research	Semiannual	5900	5500	440	410
Journal of Global Public Health	Semiannual	12000	11500	896	858
Journal of Microbiology and Related Research	Semiannual	8500	8000	664	625
Journal of Nurse Midwifery and Maternal Health	Triannual	5500	5000	430	391
Journal of Orthopedic Education	Triannual	5500	5000	430	391
Journal of Pharmaceutical and Medicinal Chemistry	Semiannual	16500	16000	1289	1250
Journal of Plastic Surgery and Transplantation	Semiannual	26400	25900	2063	2023
Journal of Practical Biochemistry and Biophysics	Semiannual	7000	6500	547	508
Journal of Psychiatric Nursing	Triannual	5500	5000	430	391
Journal of Social Welfare and Management	Triannual	7500	7000	586	547
New Indian Journal of Surgery	Monthly	8000	7500	625	586
Ophthalmology and Allied Sciences	Quarterly	6000	5500	469	430
Otolaryngology International	Semiannual	5500	5000	430	391
Pediatric Education and Research	Triannual	7500	7000	586	547
Physiotherapy and Occupational Therapy Journal	Quarterly	9000	8500	703	664
RFP Indian Journal of Medical Psychiatry	Semiannual	8000	7500	625	586
RFP Journal of Gerontology and Geriatric Nursing	Semiannual	5500	5000	430	391
Urology, Nephrology and Andrology International	Semiannual	7500	7000	586	547

Terms of Supply:

1. Agency discount 12.5%. Issues will be sent directly to the end user, otherwise foreign rates will be charged.
2. All back volumes of all journals are available at current rates.
3. All Journals are available free online with print order within the subscription period.
4. All legal disputes subject to Delhi jurisdiction.
5. Cancellations are not accepted orders once processed.
6. Demand draft / cheque should be issued in favour of "Red Flower Publication Pvt. Ltd." payable at Delhi
7. Full pre-payment is required. It can be done through online (http://rfppl.co.in/subscribe.php?mid=7).
8. No claims will be entertained if not reported within 6 months of the publishing date.
9. Orders and payments are to be sent to our office address as given above.
10. Postage & Handling is included in the subscription rates.
11. Subscription period is accepted on calendar year basis (i.e. Jan to Dec). However orders may be placed any time throughout the year.

Order from
Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi - 110 091 (India),
Mobile: 8130750089, Phone: 91-11-45796900, 22754205, 22756995 E-mail: sales@rfppl.co.in, Website: www.rfppl.co.in

Journal of Forensic Chemistry and Toxicology
Volume 4 Number 2, July - December 2018
DOI: http://dx.doi.org/10.21088/jfct.2454.9363.4218.1

Original Article

Examination of Invisible Writing Liquid Composition and Their Decoders

Harne Prajakta*, Mishra Munish K., Sodhi G.S.*****

Authors Affiliation: *Ph.D. Scholar, Department of Forensic Science, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh 211007, India. **Assistant Professor, Department of Forensic Science, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh 211007, India. ***Associate Professor, Forensic Science Unit, Shri Guru Tegh Bahadur Khalsa College, University of Delhi, New Delhi, Delhi 110007, India.

Reprints Requests: Harne Prajakta, Ph.D. Scholar-Department of Forensic Science, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh 211007, India.

E-mail: prajakta.harne@gmail.com

Received on 06.07.2018, **Accepted on** 17.09.2018

Abstract

From the earlier times of espionage, invisible ink is considered to be an assured and significant device of cryptography. Even though the use of invisible ink has now been almost entirely taken over by technical cryptography or steganography, its history still remains exceptionally fascinating, and today researchers are trying to find out readily available compositions which can inscribe secretly and their respective decoders. The art of secret writing was probably proposed to create any written text indecipherable to a reader who could read the same only after applying certain decoding process to make the writing legible. Though, the methods of secret writing are abundant but this paper principally emphases on the application of commonly available items which could act as a secret ink and similarly other commonly available items which could be applied as their respective decoders.

Keywords: Invisible Ink; Questioned Documents; Cryptography.

Introduction

According to the Merriam Webster Dictionary, 'Ink' is a colored and generally a liquid material for writing and printing. Indeed the definition is absolute as it could be perceived, by and large, in its visible appearance unless otherwise. However, the uncertainty lies in the case of Invisible Ink. As the name suggests such an object could create inscriptions obscured to bare eyes and essentially which can only be seen when it is specially treated in a way, more or less, by some chemical treatment. Invisible inks might sound fascinating and rather incredible, but they can be produced to inscribe classified information by simply using ordinarily available organic fluids. As per the available literature, there are two classes of Invisible inks, first could be 'Organic Fluids' such as lemon juice, vinegar, milk, sweat, saliva, onion juice, biological fluids and even blood and the second class of Invisible inks are known as 'Sympathetic Inks' which are comparatively complex chemical compositions and requires the application of a specific reagents or concoctions in order to be developed [1]. Use of Invisible ink, for producing concealed inscription, is also considered as a method of 'Steganography', i.e. disguising a message. Concealing a message or inscription, precisely called as Secret Writing, is any means of inscribed message whereby the writer conceals the actual written script. Codes and ciphers are every so often erroneously placed under the heading of secret writing, nevertheless this is accurate only if that expression is taken in its overall implication, as writings that are concealed anyhow. While, codes and ciphers obscure the meaning of a message, secret writing conceals the actual message. Methods of producing secret

writing include the use of invisible ink and carbon copies. Extensively applied from ancient times until the early twentieth century, secret writing has been virtuallyexclusivelytaken over by modern ways and means of concealing messages [2, 3].

This research involves the application of milk, lemon juice, Eno® (an OTC antacid), vinegar, sun cream, curd, sweat, as ink to inscribe concealed writing and detect out their respective decoders from common household items. The principle suggests that when the ink (fluids) dries out, it becomes invisible to the vision. From its antiquity, invisible inks were used as a part of communicative machinery by intelligence agencies. Although, the use of secret writing has dropped since the middle of the twentieth century due to advancement in communication technology, but this area of calligraphy still catches the attention of investigating agencies and forensic experts as the invisible inks are still used by naïve criminals for communication. The annexation of encryptions and cryptographs under secret writing brings this field under the category of disputed document examination.

The history of invisible ink dates about 2,000 years back and was employed by the ancient Greeks and romans. The first evidence of it comes from *Pliny the Elder* in the first century A.D, who cited the milk of *tithymalus* (euphorbia) plant as a form of an invisible ink in his book *Natural History*. Invisible ink sustained to be applied throughout the *Renaissance*; Statesmen used it in their literatures; & *Ovid* mentions the practice in his *Art of love.* An Italian polymath, *Giovanni Battista Della Porta*, formed a preparation for invisible ink that involved of an ounce of alum and a pint of vinegar, once coated on the casing of a hard-boiled egg, it would exude through and transfer the letter onto the white of egg. The writing could only be decrypted once the egg was unpeeled. During the revolutionary war, both the British and the Americans employed invisible ink as a method of clandestine transmission of messages. The British applied both organic fluids and common sympathetic ink. The agent of chief British intelligence officer, Major John Andre, delivered a letter as a means of their communication to report to the addressee that by which method the concealed the secret message can be developed but George Washington required more advance ink that could only be discovered by a distinctive specifically prepared reagent [4,5]. During World War- I chemical inks were engaged but basics like lemon juice and milk were still being applied. While Americans were subsiding back on old methods, the Germans were at the prominent edge of generating substantial formulations. At the beginning of the war, the Germans employed ink prepared from laxatives and medicines of headache and fever and these were easily accessible being common medicines. When the allies caught on, they were forced to formulate inks other from those based on common household items. They employed inks from sulphates of iron and copper or cobalt salts or reagent of sodium carbonate or ammonium fumes and potassium ferrocyanide. During examination it was revealed that iodine vapour turns all invisible ink brown. Both methods come up with complex means to conceal their inks.

Methodology

The present study was carried out to examine the common deciphering approaches for secret writing written with invisible inks and to know the sensitivity of these approaches over a period of time. Milk, lemon juice, Eno®, vinegar, sun cream, curd and human sweat were employed as invisible ink. Standard size blank papers were used for arranging secret writing samples and ear bud is used as a writing instrument for executing the writing. The tip of ear bud was dipped in the respective invisible ink and messages were inscribed on the blank paper. The samples with secret messages were designated at the top, with date of sample preparation bearing name of the invisible ink and the corresponding day on which it required to be examined. Additional samples of secret messages were also arranged in the same way. The papers comprising written messages were let air dry transforming the inscription invisible. These samples were left at normal room temperature and conditions. They were then examined at even interval of five days for one month by means of crude methods including chemically by the acid-base reaction and also physically by applying magnetic powder. Following categories of decoders were applied for the given purpose:

Decoders-

- **D1 = Mustard Oil**

Mustard oil is common edible oil available in every household grocery containing 99% fat. These fats are liquid because it consists of fats which are chiefly unsaturated.

• **D2 = Crystal Violet**

Crystal Violet stain is prepared by mixing two pre- prepared solutions of which first is prepared by dissolving 2g of crystal violet dye in 20 ml of 95% ethyl alcohol and second dissolving 0.8 g ammonium oxalate monohydrate in 80 ml deionized water.

• **D3 = Sodium Chloride + Phase Transfer Catalyst (PTC)**

While Sodium Chloride is known as Common Salt the PTC is a catalyst that enables the passage of a reactant through one phase to other phase where reaction takes place. Phase-transfer catalysis is a distinctive formula of heterogeneous catalysis. Ionic reactants are generally soluble in an aqueous phase but insoluble in an organic phase in the absence of the phase-transfer catalyst. The catalyst functions like a detergent for solubilizing the salts into the organic phase [6].

• **D4 = Tamarind**

Tamarind is a regular sour food item.

• **D5 = Tamarind + Sodium Chloride**

Tamarind is regular food item. Similarly, sodium chloride is the common salt.

• **D6 = Crystal Violet + Sodium Chloride**

• **D7 = Whisky + Sodium Chloride**

Whisky is a purified alcoholic drink prepared from fermented grain pulp. Several grains are applied for diverse ranges, comprising barley, maize, rye, and wheat. And Sodium chloride has been applied to taste and preserve foods for several of years. Sodium chloride has other applications beyond flavour and antibacterial protection to foods.

• **D8 = Magnetic Powder**

Magnetic powder enhances an extensive variety of flexibility to one's resources of developing prints such as fingerprint or palm print. In general, magnetic powder is applied on non-magnetic planes, and regular powder on iron-based planes.

Results and Discussion

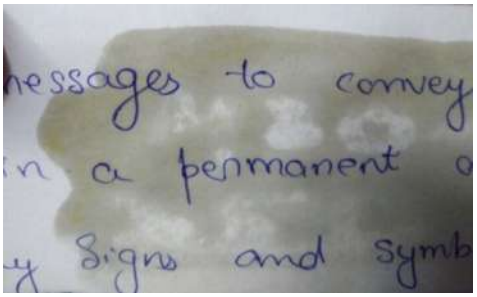
When applied with the appropriate, aforementioned, decoders the fluids used as invisible ink showed distinctive results (Table 1 Fig. 1).

The fluids which are used are commonly encountered in daily routine and most of them have basic compositions. The decoders which are used in the present study are also available in general household items. The experiments showed that the decoders are giving significant results to visualize the invisible fluids used as an instrument of secret writing. As the objective of the study was to identify the suitable and most appropriate decoders to visualize the fluids, it was observed that chemical decoders are however more likely to give better results. In the present case the combination of Sodium Chloride and Phase Transfer Catalyst produced good results (Fig. 2). Similarly, to an extent the physical decoder used in the study, i.e., the magnetic powder, also gave satisfactory results. However, its limitation can be exempted due to the reason of its coarse property

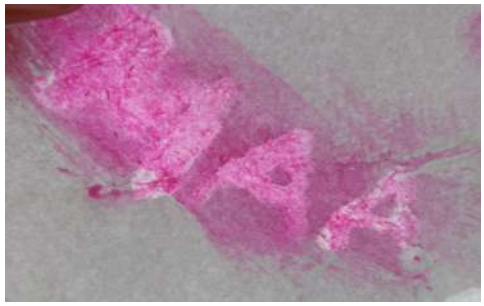
Table 1: Results of decoders upon the fluids

Fluids	Decoders							
	D1	D2	D3	D4	D5	D6	D7	D8
Milk	+	-	-	-	-	-	-	-
Lemon	-	-	+++	-	-	-	-	-
Eno®	-	-	-	-	+++	-	++	-
Vinegar	-	-	+++	-	-	+++	-	-
Suncream	+++	-	-	-	-	-	-	-
Curd	+	-	-	-	-	-	-	-
Sweat	-	++	-	-	-	-	-	++

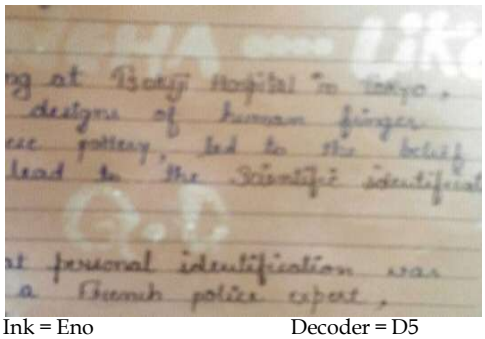
+ (Partial clear); ++ (Clear); +++ (Very clear) ; - (No result)



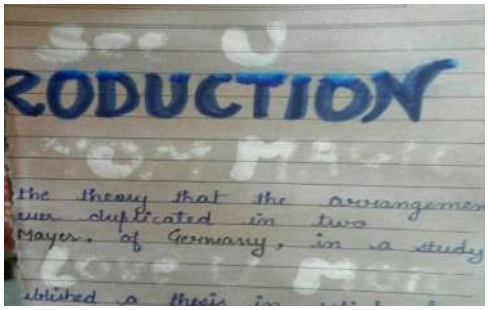
Ink = Milk Decoder = D1



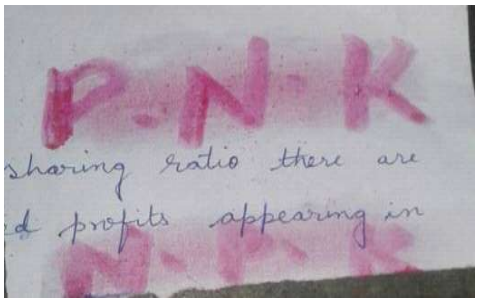
Ink = Lemon Juice Decoder = D3



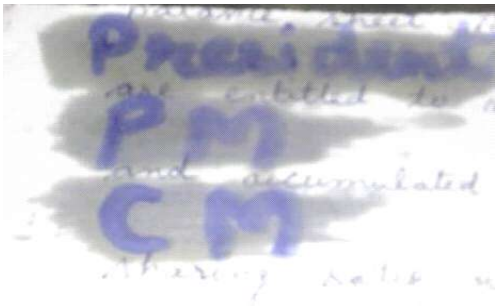
Ink = Eno Decoder = D5



Ink = Eno Decoder = D7

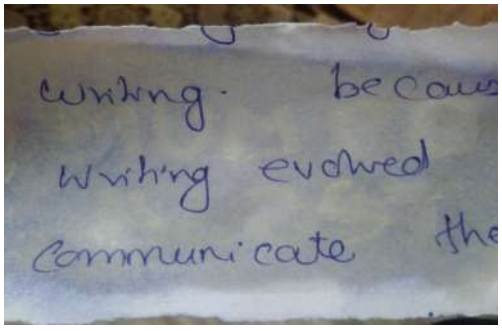


Ink = Vinegar Decoder = D3

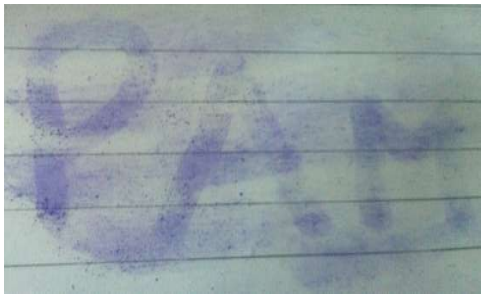


Ink = Vinegar Decoder = D6

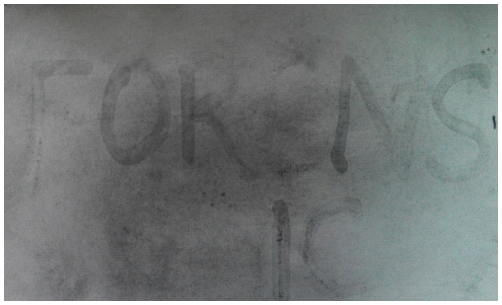
Ink = Sun Screen Decoder = D1



Ink = Curd Decoder = D1



Ink = Human Sweat Decoder = D2



Ink = Human Sweat Decoder = D8

Fig. 1: Images of decoded secret writing

and large particle size. Most interestingly, it was observed that mustard oil, i.e., commonly used edible item, can be used as a good decoder as it showed adequate results.

Conclusion

The progress in the field of questioned document examination, by the development of new techniques, are invented or adapted from elsewhere in science [7].

In recent years, the use of the laser, visible light spectroscopy, liquid chromatography has been introduced for ink related queries. From the results obtained in this research, it can be concluded that the secret writings executed with different fruit extract, chemical and biological fluids can be decrypted by physical and chemical methods. Further research considering a larger sample size and taking more factors will assist to gain an enhanced understanding of the visualization methods most appropriate for developing secret writing.

References

1. Andharmule D, Kapoor N, Badiye A. An Evaluation of Some commonly used Methods for Visualization of Secret Writing. Research Journal of Forensic Sciences. 2013;1:1-4.
2. Gardner, Martin. Codes, Ciphers, and Secret Writing. New York: Pocket Books, 1974.
3. Zim, Herbert Spencer. Codes and Secret Writing. New York: W. Morrow, 1948.
4. Lardner George, Jr., Panel Proposes Tougher Laws against Espionage, Washington Post, (May 24, 1990): A16. (1990).
5. "Secret Writing." Encyclopedia of Espionage, Intelligence, and Security. 2004. Retrieved April 17, 2013 from Encyclopedia.com: http://www.encyclopedia.com/doc/1G2-3403300676.html.
6. Desikan Sridhar and Doraiswamy L K, Chemical Engineering Science, 2000;55:6119-6127.
7. Wilson R. Harrison, Suspect Document, 2008;3: 494-533.

Instructions to Authors

Submission to the journal must comply with the Guidelines for Authors.

Non-compliant submission will be returned to the author for correction.

To access the online submission system and for the most up-to-date version of the Guide for Authors please visit:

http://www.rfppl.co.in

Technical problems or general questions on publishing with JFCT are supported by Red Flower Publication Pvt. Ltd's Author Support team (http://rfppl.co.in/article_submission_system.php?mid=5#)

Alternatively, please contact the Journal's Editorial Office for further assistance.

Editorial Manager

Red Flower Publication Pvt. Ltd.

48/41-42, DSIDC, Pocket-II

Mayur Vihar Phase-I

Delhi - 110 091(India)

Mobile: 9821671871, Phone: 91-11-22754205, 45796900, 22756995

E-mail: author@rfppl.co.in

Original Article

Journal of Forensic Chemistry and Toxicology
Volume 4 Number 2, July - December 2018
DOI: http://dx.doi.org/10.21088/jfct.2454.9363.4218.2

Variation in Length of Signatures in Case of Simulated Forgery

Harne Prajakta*, Mishra M.K., Sodhi G.S.*****

Authors Affiliation: *Ph.D. Scholar, Department of Forensic Science, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh 211007, India. **Assistant Professor, Department of Forensic Science, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh 211007, India. ***Associate Professor, Forensic Science Unit, New Delhi, Delhi 110007, India, University of Delhi, New Delhi, Delhi 110007, India.

Reprints Requests: Harne Prajakta, Ph.D. Scholar, Department of Forensic Science, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh 211007, India.

E-mail: prajakta.harne@gmail.com

Received on 11.07.2018, **Accepted on** 17.09.2018

Abstract

Simulated or imitation forgery is one of the pervasive forgeries among the group of forgers, where genuine signature of signatory authority is available to forger and he attempts to execute by following the pictorial effect of the design of the signature by simply drawing the same. However, several factors are revealed during this act of forgery. Not every reproduction has a perfect evidence of poor line quality, retouching, and other "classic" features that may establish it as a fraud. Others, specifically those carried out when copying simple short signatures may have a line quality not very diverse from the signature and can be made without pen lifts, retouching, or tracing. In such cases, it may not be probable to opine with an extraordinary degree of confidence that the questioned writing is an imitation, but, according to its degree of inaccuracy, that exist, it may be apparent to postulate forgery.

Keywords: Simulated Forgery; Forensic Science; Handwriting Examination.

Introduction

Of the many complexities associated with the identification of handwriting, there is none more challenging than the 'wilful transformation' of writing [1]. Within the wide-ranging field of forensic science, the scientific examination of documents has one of the main purpose is to provide information about the history of document, its authenticity, its effectiveness for the assistance of legal proceedings. In the world of business and literacy most of the transactions takes place through documents. While, document is a piece of handwritten, type written, printed, or electronic script that predicts information and which serves as an official record or evidence, a questioned document is defined as any document whose authenticity is uncertain. There are several direct reasons due to which documents may have to be examined in criminal investigation.

A further cause for apparent resemblances occurring in conjunction with differences is that one of the parts of writing being compared is a simulation. Simulated signature is one that is not written in the name of the actual signatory and attempt has been made by them to copy or simulate the signature of another person [2]. The methods applied to imitate writing, mostly signatures, of other people. To prevent self-incrimination, a person may disguise their handwriting at the same time as fraudulently manipulating financial data or altering legal or other documents for financial gain or other personal benefit [3,4]. Whether the technique adopted by forger is a rapidly drawn copy, a

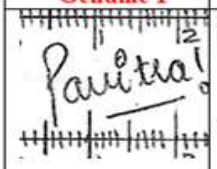
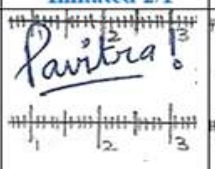
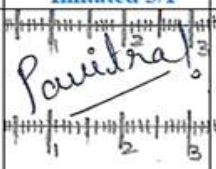
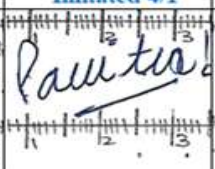
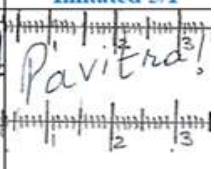
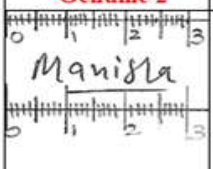
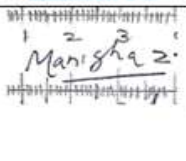
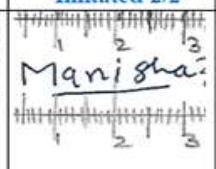
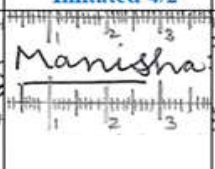
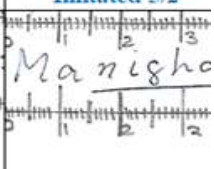
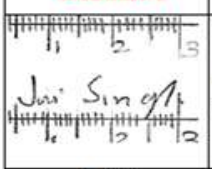
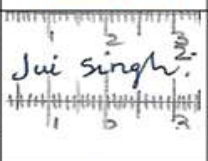
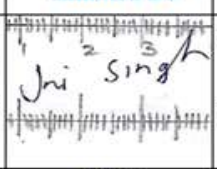
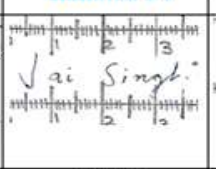
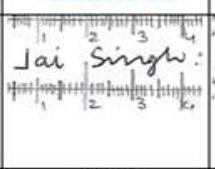
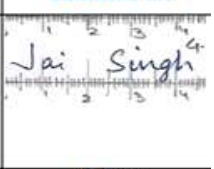
gradually developed freehand simulation, or a tracing, evidence will normally be found. In several cases, the pattern of such characteristics offers direct evidence that simulation has followed. The natural variations predominant in the writings of an individual can mislead as an evidence of imitation. If deficient samples of signatures are available for comparison, the entire range and freedom of variation cannot be appreciated by the examiner. This indicates that significant differences can be present due to imperfection in replication which could be variations as well. Another very similar confusing concept exists contradicting forgery is 'disguise'. There is little disagreement in the literature that the term 'disguise,' as it relates to handwriting, is taken to mean a deliberate distortion or modification of an individual's natural style of writing in an attempt to alter its appearance sufficiently to conceal the identity of its author [5,6,7]. An examination of the movement of the pen and the manner in which the writing was produced is 'highly significant' in determining the 'quality of naturalness or artificiality in writing' [8]. It is challenging to specify exact number of signatures required to establish the range of variation, although 10 specimens are collected over a period preferably including the time of the signature in question. Smaller number of specimen could be adequate if there is apparent evidence of simulation in the suspect writing or consistency of difference between a number of simulations and the genuine signatures.

When noteworthy dissimilarities typical of those exist when signatures or other writings are copied are revealed in a questioned signature, andare not existing in sufficient number of those identified to be genuine, it can safely be opined that the signature is not the genuine signature of the signatory authority [9,10,11]. If it also indicates a clear overall resemblance to the genuine signatures, it can be reported as a simulation with no indication that it was made by the authorized signatory of the genuine signature.

Methodology

Standard signatures were obtained from ten (10) healthy individuals irrespective of their age and gender. Each signature was attributed to at least one member of the standard group. Volunteer group containing eighty (80) individuals irrespective of their age were asked to replicate the ten accredited signatures leading to the procurement of eight hundred (800) imitated signatures. However, the gender ratio of the volunteer group was kept uniform as it contained forty (40) males and forty (40) females. Abundant time was allowed to the volunteers to replicate the genuine signatures which were analysed for the variation in their lengths. In order to study the variation of length of signature

Table 1: Sample Collection

Signature Model 01					
Genuine 1	Imitated 1/1	Imitated 2/1	Imitated 3/1	Imitated 4/1	Imitated 5/1
					
1.8 cm	2.4 cm	2.5 cm	2.6 cm	2.7 cm	2.8 cm
Signature Model 02					
Genuine 2	Imitated 1/2	Imitated 2/2	Imitated 3/2	Imitated 4/2	Imitated 5/2
					
2.3 cm	2.8 cm	2.7 cm	3.1 cm	3.4 cm	3.6 cm
Signature Model 03					
Genuine 3	Imitated 1/3	Imitated 2/3	Imitated 3/3	Imitated 4/3	Imitated 5/3
					
2.4 cm	2.9 cm	3.0 cm	3.3 cm	3.7 cm	4.1 cm

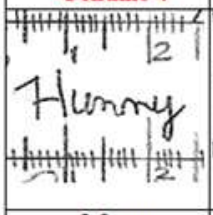
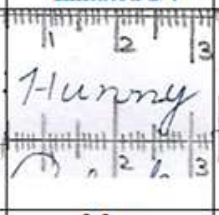
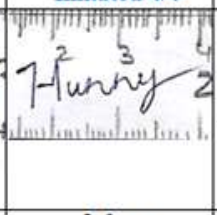
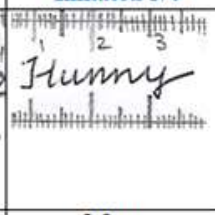
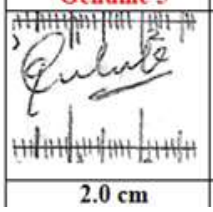
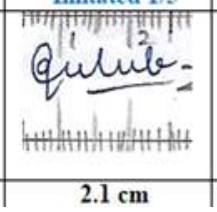
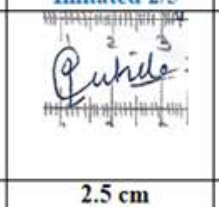
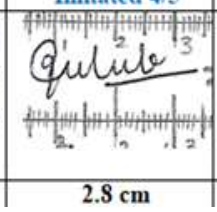
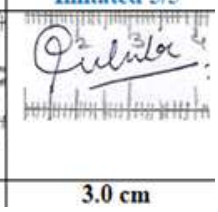
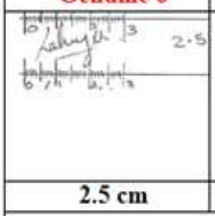
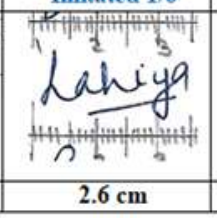
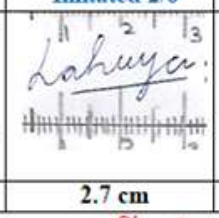
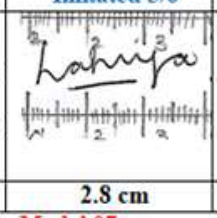
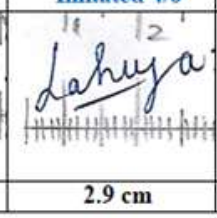
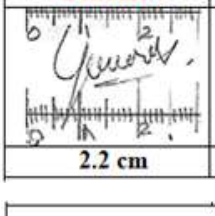
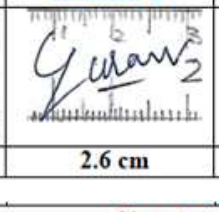
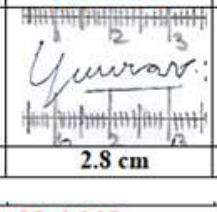
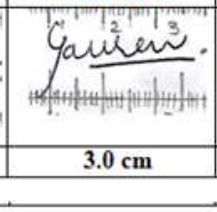
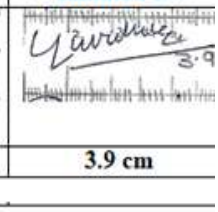
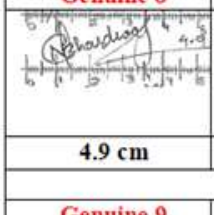
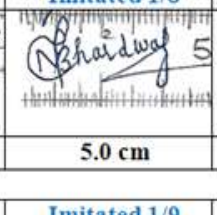
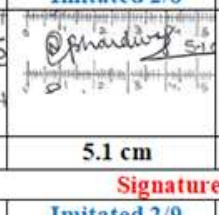
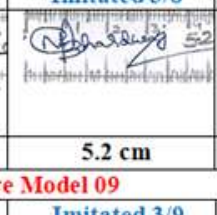
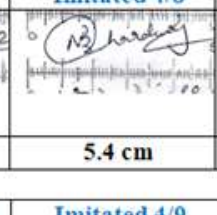
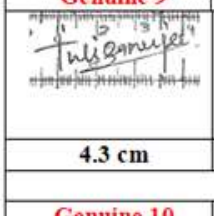
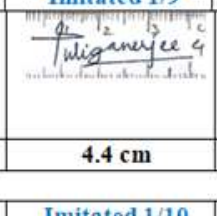
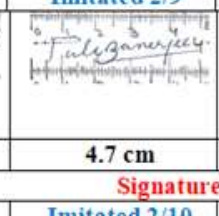
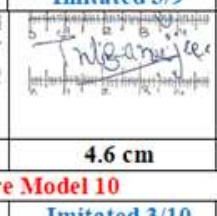
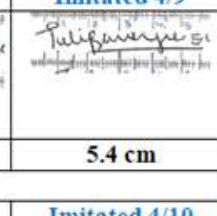
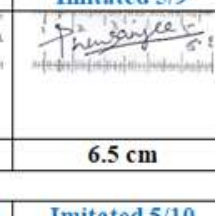
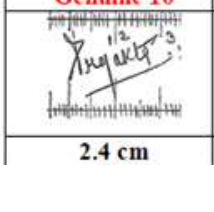
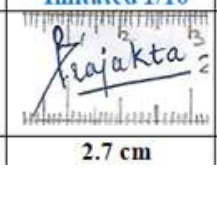
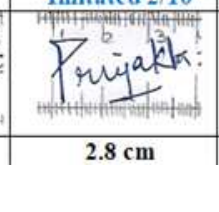
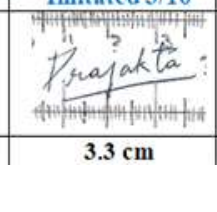
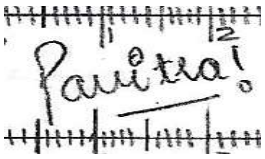
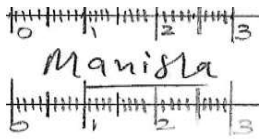
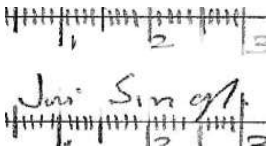
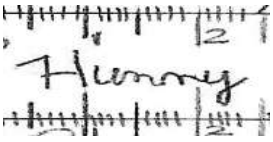
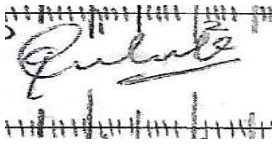
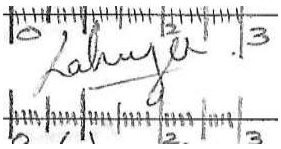
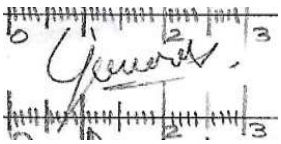
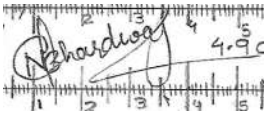
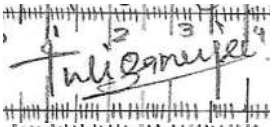
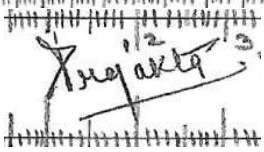
Signature Model 04					
Genuine 4	Imitated 1/4	Imitated 2/4	Imitated 3/4	Imitated 4/4	Imitated 5/4
					
1.9 cm	2.2 cm	2.3 cm	2.4 cm	2.6 cm	2.9 cm
Signature Model 05					
Genuine 5	Imitated 1/5	Imitated 2/5	Imitated 3/5	Imitated 4/5	Imitated 5/5
					
2.0 cm	2.1 cm	2.5 cm	2.7 cm	2.8 cm	3.0 cm
Signature Model 06					
Genuine 6	Imitated 1/6	Imitated 2/6	Imitated 3/6	Imitated 4/6	Imitated 5/6
					
2.5 cm	2.6 cm	2.7 cm	2.8 cm	2.9 cm	3.0 cm
Signature Model 07					
Genuine 7	Imitated 1/7	Imitated 2/7	Imitated 3/7	Imitated 4/7	Imitated 5/7
					
2.2 cm	2.5 cm	2.6 cm	2.8 cm	3.0 cm	3.9 cm
Signature Model 08					
Genuine 8	Imitated 1/8	Imitated 2/8	Imitated 3/8	Imitated 4/8	Imitated 5/8
					
4.9 cm	5.0 cm	5.1 cm	5.2 cm	5.4 cm	5.5 cm
Signature Model 09					
Genuine 9	Imitated 1/9	Imitated 2/9	Imitated 3/9	Imitated 4/9	Imitated 5/9
					
4.3 cm	4.4 cm	4.7 cm	4.6 cm	5.4 cm	6.5 cm
Signature Model 10					
Genuine 10	Imitated 1/10	Imitated 2/10	Imitated 3/10	Imitated 4/10	Imitated 5/10
					
2.4 cm	2.7 cm	2.8 cm	3.3 cm	3.7 cm	3.9 cm

Table 2: Mean values of the signatures*

	Standard signatures	Original length of standard signatures (cm)	Mean value for length of 10 samples of standard signatures (cm)
1.		1.8	1.8
2.		2.2	2.3
3.		2.4	2.4
4.		1.9	1.9
5.		2.4	2.0
6.		2.5	2.5
7.		2.2	2.2
8.		4.8	4.9
9.		4.5	4.2
10.		2.2	2.4

*This table shows the permissible instability of natural variation in the length perspective.
Total numbers of imitated signatures = 800

Percentage Value

% Change: (Calculated Value / Total Value) x 100
Therefore,

- % Increase in length = (538/800) x 100
  = 67.250%
- % Decrease in length = (203/800) x 100
  = 25.375%
- % Equal length = (59/800) x 100
  = 7.375%

of genuine writer, 10 samples from each writer were acquired. The measurements of these signatures are also taken into account by considering their mean value (Table 1 & 2).

Results& Discussion

Attempts have been made by the authors to identify the variation in length of simulated signature and for this purpose authors collected ten (10) genuine signature pattern and same have been imitated by eighty (80) individuals of equal gender distribution, i.e., forty (40) males and forty (40) females. The results showed that 67.250% individuals displayed increased length in simulated signatures, 25.375% shows decreased length and 7.375% did not show any noticeable change. The substantial prospect indicated that length of forged signature plays important role which could be taken into consideration for the purpose of comparison of handwriting. After examination, length analyses revealed that majority of the simulated signatures were increased in length with a percentage of 67.25%, while 25.37% were decreased and 7.37% remains almost unchanged in comparison to the standard samples (Table 3a,b).

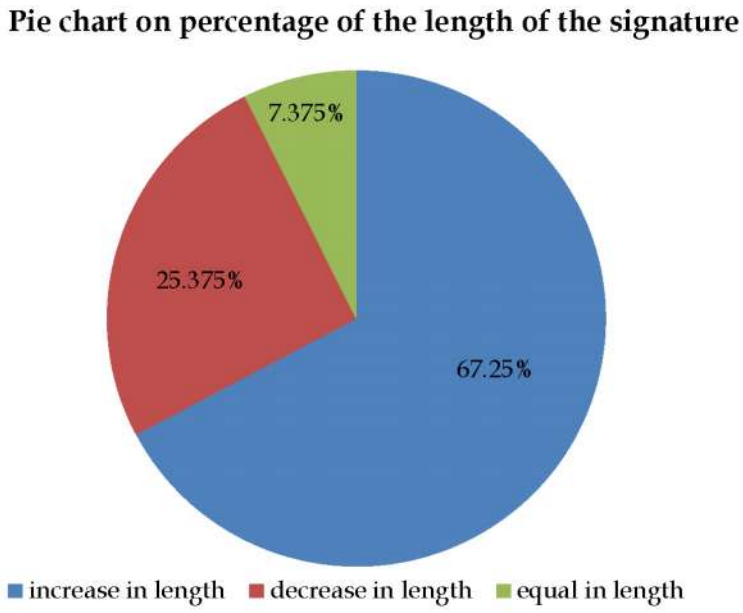


Table 3a: Result in Graphical Form

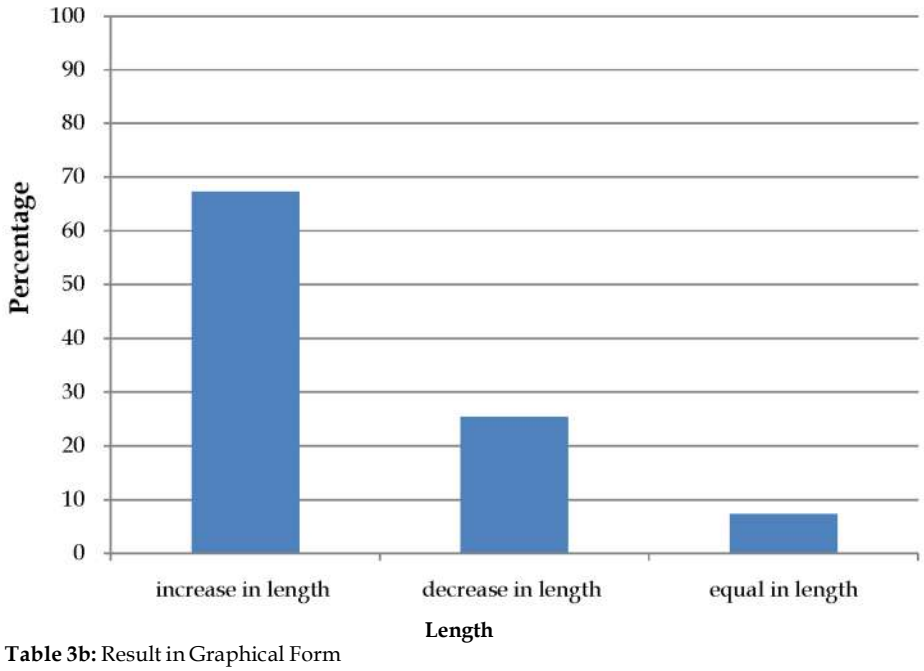


Table 3b: Result in Graphical Form

Conclusion

Detection of forged documents requires due vigilance on the part of expert. Some documents are more susceptible to alteration, and some business sectors or activities are riskier than others. This research article outlines one of the vital element of forgery i.e., length of signature for simulated signatures. It can be calculated as a primary method during the examination of simulated forgery. This makes the examination more effective as well as it should also be noted that all the signatures during the process of constructing juxtapose should be always scanned by keeping measuring scale adjacent to the each and every signature. This prevents alteration in dimensions caused by magnification process followed during the act of getting the various categories of signature i.e., Questioned, Admitted and Specimen adjacent to each other for the purpose of comparing signature by reducing error caused by movement of eye on various documents. The given study concludes that in majority of simulated forged signature, the forger increases the length of signature as compared to the specimen sample. Therefore, unusual increase in the length of the signature indicates signs of forgery. This study will help the document experts to distinguish between the forged or genuine signature and could be appreciated by the forensic community.

Reference

1. Sedeyn, M.J. The Hand and the Trace; Some Issues in Handwriting. Visible Language, 1990;24:164-75.
2. Bradford, R.R. and Bradford, R.B. Introduction to Handwriting Examination and Identification. Chicago: Nelson-Hall. 1992.
3. Webb F.E. The Question of Disguise in Handwriting. Journal of Forensic Sciences, 1977;23(1):149-54.
4. Koppenhaver K.M. Attorney's Guide to Document Examination. Westport, Connecticut, London: Quorum Books. 2002.
5. Harris J.J. Disguised Handwriting. Journal of Criminal Law, Criminology, and Police Science, 1953;43(5):685-89.
6. Baker J.N. Law of Disputed and Forged Documents. Charlottesville, Virginia: The Michie Company.1955.
7. Hilton O. Scientific Examination of Questioned Documents. New York: Elsevier North Holland Inc. 1982.
8. Osborn A.S. Questioned Documents. 2nd edn. Albany, New York: Boyd Printing Company Ltd. 1929.
9. Robertson E.W. Fundamentals of Document Examination. Chicago: Nelson-Hall, 1991.p.157.
10. Koppenhaver K.M. Evaluating Evidence: A Systematic Examination of the Handwriting Characteristics in Suspect Document Cases. Joppa: The Forensic Publishers of Joppa. 1990.
11. Koppenhaver K.M. Document Examination: Principles and Practice. New Jersey: Humana Press Inc. 2007.

Journal of Forensic Chemistry and Toxicology
Volume 4 Number 2, July - December 2018
DOI: http://dx.doi.org/10.21088/jfct.2454.9363.4218.3

Case Series

A Series Case Reports of Four Accidental Sewer Gas Poisoning

Pandit J.N.*, Chandran V., Dhaka S.**, Millo T.*****

Authors Affiliation: *Junior Resident **Senior Resident ***Professor, Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences, New Delhi 110029, India.

Reprints Requests: Millo Tabin, Professor, Faculty Incharge: Forensic Toxicology and DNA Lab, Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences, New Delhi 110029, India.

E-mail: tabinmillo2003@rediffmail.com

Received on 09.11.2018, **Accepted on** 03.12.2018

Abstract

Sewer gas (H_2S) is a toxic gas generally produced naturally by decaying organic matter. Death in sewer gas poisoning is due to respiratory arrest. Acute exposure of Hydrogen sulphide causes cytochrome oxidase enzyme inhibition causing disruption of oxidative metabolism and affecting nervous system and cardiac tissue immediately. It affects almost all system like, CNS, respiratory, cardiovascular, renal, gastrointestinal, dermal and ocular system. The powerful effect of hydrogen sulphide over olfactory inhibition makes the people unaware to its characteristic rotten egg odour. Rarely hydrogen sulphide poisoning occurs by intention but most of the case is accidental. Hydrogen sulphide is highly toxic and flammable gas, and, because of heavier than air it is accumulated at the bottom of poorly ventilated and closed space. In India it is observed that most of the sewer cleaning is done manually and the workers are not aware to its harmful effect because of lack of knowledge, so they unfortunately comes under its silent dangerous effect. There are standards and guidelines for exposure of hydrogen sulphide at work place; if it is followed and proper safety measures are taken then incidence will be reduced. Here we are reporting a series of four cases of accidental sewer gas poisoning, the autopsy of which were done in our mortuary, AIIMS, New Delhi.

Keyword: Sewer Gas; Hydrogen Sulphide; Flammable Gas etc.

Introduction

Hydrogen sulphide is a major constituent of sewer gas, along with this it also contains carbon mono-oxide and methane. Death in sewer gas poisoning is mainly due to H_2S which cause asphyxia as a result of respiratory paralysis. H_2S is a colourless, flammable, heavier then air, moderately water soluble and highly toxic gas. It has a characteristic "rotten egg" odour and sweat in test [1,2,3]. However, odour is not a reliable indicator of presence of hydrogen sulphide and may not give adequate alarm of hazardous concentration because of its powerful effect over olfactory inhibition [2,4].

Hydrogen sulphide occurs naturally in the environment in sewer and volcanic gas, coal pits, swamps, marshes and in several industries, it is generated as a by-product of organic decomposition by anaerobic bacteria like sulphate reducing bacteria (such as salmonella), but the gut enzymes exist in the body capable of detoxifying it by oxidation to harmless sulphate [1,3,5].

OSHA (Occupational Safety and Health Administration) recorded 13 work-related asphyxiation deaths, mostly death occurs accidently but a case report in Japan reported 17 autopsy case of fatal hydrogen sulphide poisoning due to inhalation of intentionally generated hydrogen sulphide gas. This may be generated by mixing sulphur based bath powder or pesticides and acidic detergents [2,6,7]. In India most of the sewer cleaning is done manually by entering inside the sewage and the workers are not aware to its harmful effect because of lack of knowledge so they unfortunately comes under its silent dangerous effect.

Case Report One A

As per inquest by the police of Lajpat Nagar police station, New Delhi, on 07/08/2017 morning, there were four persons carrying out the cleaning work of the sewer line who were directed by the contractor to clean 25 sewer holes from Jal Sadan to Ring Road, near Jal Vihar, Lajpat Nagar, New Delhi. On 06/08/2017 at about 10:30 am they were involved in the cleaning job without proper safety dress, equipments like mask, cylinder etc. because the safety gadgets were costly and they were not available with the contractor. After cleaning 3 to 4 holes in front of MCD Office Jal Vihar Road, three of them went to clean the next hole at opposite to Sant Kabir Ram Mandir, Lajpat Nagar at around 12:00 pm and the fourth person went for another work.

After 10 minutes the three became unconscious and felt down inside the sewer hole while cleaning the lid of the hole. When this incidence came in knowledge of fourth one, he tried to go inside the holes for taking out his co-workers but he got some uneasiness and came out. The police came immediately and removed the workers with the help of Fire Brigade team and brought him to AIIMS Hospital, New Delhi as early as possible, where they were declared brought dead at 3:19 pm to 3:25 pm. All three deceased were brought to AIIMS mortuary for preservation in cold chamber (4°C) till conducting autopsy on next day.

On examination, the first case was 24 year old male having average built wearing wet cloths with mud stained. "Rotten egg" smell was coming out from the body. Nail beds were bluish in colour, post-mortem hypostasis was present over back and dependent parts of body except pressure areas in supine position and was fixed, rigor mortis were well developed all over the body including distal interphalangeal joint of fingers and toes. The cornea and conjunctiva were clear.

The teeth, gums and lips including mucosa were intact. There were multiple reddish brown colour abrasions noted over body at places. The pleural cavity, diaphragm, peritoneal cavity, inner abdominal walls and urinary bladder and all internal organs were intact and present in its normal anatomical position. Trachea was congested, and bilateral lungs were congested, oedematous and having multiple ecchymosis over their surface of lower lobes. All other visceral organ and brain were congested. Stomach contains about 100 ml of greenish colour fluid and having congested mucosa.

Fig. 1: Sewage hole

Fig. 2: Cyanosis of finger nails

Case Report One B

The second case was a 33 years old male having same built as first, wearing mud stained cloths. No any smell was detected over body. Post mortem hypostasis, rigor mortis, nail beds, eye, lips, teeth, gums, cavities and visceral organ finding were same as the first case. No any external ante mortem injury was noted over body. The lungs were congested and oedematous along with Petechiae present over the surface. About 50 ml greenish colour fluid was present in stomach and mucosa of stomach was congested.

Fig. 1: Congestion of stomach mucosa

Case Report One C

Third case was a 27 years old male also having average built wearing mud stained cloths and musty odour coming from the body. Rigor mortis and hypostasis as well as other external findings were as first case. Multiple old healed transverse scar marks were present over anterior aspect of left forearm. There was no external ante mortem injury found over body. Internal organ were congested and lungs were oedematous having Petechiae diffusely over the lung surfaces. Stomach contains 100 ml of greenish colour fluid with congested mucosa.

In all three cases viscera were preserved, along with blood sample in EDTA vial preserved under liquid paraffin to detect presence of sewer gases (H_2S, methane, ethane, CO_2 etc.)

Fig. 1: Petechial haemorrhage in lung pleura

Case Report Two

A request made by police from Neb Sarai police station with a history of deceased falling down in to septic tank while cleaning of same on 18/02/18 at about 11:30 am, and then he was taken to AIIMS casualty, New Delhi where he was declared brought dead on 4:35 pm on same day. Then he was brought to AIIMS Mortuary for autopsy at 5:25 pm but body was preserved for next day in cold chamber. On next day autopsy was done. On external examination the cloths of deceased was smeared with some blackish brown material. The rigor mortis was established and retained; Post mortem lividity was present over back and was fixed. Cornea was hazy and conjunctiva was congested, nail beds were bluish in colour. Teeth, gums, frenulum and lips including mucosa were intact. No any external ante mortem injury was present over body. Internal examination shows congested brain, lungs and all other visceral organs along with the mucosa of stomach. The stomach contains about 30 ml mucoid fluid. The heart was normal in size and their walls, valves and chambers were intact, the coronaries were patent. The cavities, diaphragm and urinary bladder were intact. Cause of death in this case was given as death due to asphyxia due to suffocation consequent upon inhalation of sewage gas. However viscera along with blood sample in EDTA vial under liquid paraffin were preserved to rule out any concomitant poisoning and detection of presence of sewer gas.

Toxicological Analysis

Toxicological analysis of viscera of case one A, B and C showed the evidence of presence of Hydrogen sulphide and ethyl alcohol (having blood concentration of 24.4 mg, 6.8 mg and 14.4 mg per 100 ml of blood respectively).

Causes of death in all first three cases were given as death due to hydrogen sulphide poisoning due to sewer gas exposure. The cause of death in the fourth case was given however viscera and blood sample reports were still waiting.

Discussion

Sewer gas is a generic name of mixture of gases and airborne agents that often accompany sewage and the natural processes and reactions associated with sewage processing and the decomposition of organic materials. The major compositions of sewer gas include: hydrogen sulphide (H_2S), carbon dioxide (CO_2), methane (CH_4), ammonia (NH_3), biological organisms, water vapour, and other chemicals. The presence and concentration of any of these components can vary with time, composition of the sewage, temperature and Ph [8].

The major adverse health effects and hazards from exposure to sewer gases are due to poisoning from H_2S, Asphyxiation from displaced or consumed oxygen. Decreased vigilance or fatigue due to reduced oxygen levels (from CO_2 and CH_4). Hydrogen sulphide is highly toxic and flammable gas, and, because of heavier then air it is accumulated at the bottom of poorly ventilated and closed space. Despite of its bad (characteristic "rotten egg") odour it is not easily detected by

workers because of its inhibitory action on olfactory nerve ending at high concentration and people become faint without any aware [9]. The odour threshold (0.5 ppb) is much lower than the OSHA (Occupational Safety and Health Administration) permissible limit of ceiling (20 ppm). The standards and guidelines for exposure of hydrogen sulphide at work place are as follows, OSHA ceiling is 20ppm, OSHA maximum peak is 50 ppm (10 minute, once during an 8 hour shift, no other exposure), and NIOSH IDLH (National Institute of Occupational Safety and Health Immediately Dangerous to Life or Health) is 100 ppm [4]. The route of exposure may be inhalational, through surface contact (skin/eye) or ingestion. Hydrogen sulphide is quickly absorbed through lungs and gastrointestinal tracts. The elimination of this poison is through the lungs and faeces, and their metabolites are passes through urine as thiosulfate.

On acute exposure, H_2S causes inhibition of the cytochrome oxidase enzyme system causing lack of oxygen in the cell which leads to anaerobic metabolism and accumulation of lactic acid which further causes acid-base imbalance. It also affects CNS, Respiratory, Cardiovascular, Renal, Gastrointestinal, Dermal and ocular system. CNS symptoms are immediate and lead to loss of consciousness, inhibition of respiratory centre, seizure depression and death. It is a mucous membrane and respiratory tract irritant which may lead to breathlessness, cough, pulmonary oedema and bronchial or lung haemorrhage.

Safety Precautions

Education of the workers regarding the potential lethal effects of the job they are involved and the early symptoms of accidental poisoning will be helpful to avoid these types of mishaps.

Proper safety measures should be taken at work place.

1. The manholes should be opened and ventilated at least one hour before entering the workers inside, and the area around the workplace, if it is at road side, should be cordoned off with railing and warning signal should be put to avoid RTA.
2. Before entering, the presence of toxic gases should be tested by wet lead acetate paper test (colour changes from white to grey to black depending upon concentration of Hydrogen sulphide).
3. Pressure of oxygen should be measured by lowering detector lamp. If there is less or no oxygen, personnel should go with oxygen kit.
4. The personnel should tie safety belt with rope with two men standing outside the hole to pull out in emergency.
5. Air blower should be available at the site of working place to flow fresh air.

Besides these safety measure we can use Vacuumed system to minimise the accident, which works on the basis of differential pressure between atmosphere and vacuum creating negative pressure in machine which propels the sewage towards the vacuum station. It is cost effective, require single source power, operator and environment friendly as the operator never comes in contact with sewage. So confined space would not be an issue, and the system is entirely closed and air proof.

Relevant laws in India dealing with sewage cleaning [10,11]. In India, an act was passed called: The prohibition of employment as manual scavengers and their rehabilitation act 2013. As per this act the "Hazardous cleaning" by an employee, in relation to a sewer or septic tank, means its manual cleaning by such employee without the employer fulfilling his obligations to provide protective gear and other cleaning devices and ensuring observance of safety precautions, as may be prescribed or provided in any other law, for the time being in force or rule made there under. The "insanitary latrine" means a latrine which require human excreta to be cleaned or otherwise handled manually, either in situ, or in an open drain or pit into which the excreta is discharged or flushed out, before the excreta fully decomposes in such manner as may be prescribed. The "sanitary latrine" means a latrine which is not an 'insanitary latrine'. A "septic tank" means a water-tight settling tank or chamber, normally located underground, which is used to receive and hold human excreta, allowing it to decompose through bacterial activity. The "Sewer" means an underground conduit or pipe for carrying off human excreta, besides other waste matter and drainage wastes.

This act prohibits the employment of manual scavengers or manual cleaning of sewers and septic tanks without protective equipment.

As per the rules issued after the act came into force, 40 items are prescribed as protective gear for sewer workers such as airline breathing apparatus, Artificial respiration/reticulate,

Blower, Breath mask, Emergency medical oxygen resuscitator kit, First Aid box, gas monitor, Hand gloves, Helmet, Life guard pad, Safety body clothing, safety goggles etc. and a specialised unit.

The act prescribes the first aid measures to be available in the work place. The following first aid facility should be provided and maintained, so as to be easily accessible during working hours. There should be not less than one first-aid box for 150 employees [1].

For less than 50 workers, each first aid box should contain:

a. 6 small, 3 medium and 3 large size sterilised dressings,
b. 3 large sterilised burn dressings,
c. 30 ml (1 bottle) 2% alcohol solution iodine,
d. 30 ml of salvolatile labelled with dose and mode of administration,
e. 1 snakebite lancer,
f. 30 gm (bottle) of potassium permanganate crystals,
g. One pair scissor,
h. 100 tablets of Aspirin (5 gm),
i. Ointment for burn,
j. A bottle of suitable surgical antiseptic solution
k. A copy of the first aid leaflet issued by Director General, Factory advice service, and Labour Institute Government of India [2].

For more than 50 workers, the number of dresses should be doubled and amount of 2% alcohol solution, iodine and salvolatile should be 60 ml along with one roll of adhesive plaster. Other materials are as above. The first-aid box should be distinctly marked with a Red cross on white back ground.

The law enforcement authorities should be able to define this hazardous work atmosphere present in most of the cities in India. Need of strict implementation of rules and protocols are needed. The compliance from the part of contractors must be evaluated. This act also has guide line for "Prohibition of insanitary latrine and employment and engagement as manual scavenger" (sec. 5), "Contract agreement" (sec.6), "Prohibition of persons from engagement and employment for hazardous cleaning of sewer and septic tanks" (sec. 7) in Chapter III of the act. If any contravention has occurred of section 5 or 6, the culprit is punishable with an imprison for a term which may extended to one year or with fine which may extended to fifty thousand rupees or with both for first contravention, and for subsequent offence it will be two years or one lakh rupees or with both. For violation of section 7 it will be two years or two lakh rupees or with both for first offence and five years or five lakh rupees or both for second offence respectively.

The death due to sewar gas poisoning at work may also be charged under U/S 304/177/218/417/468/471 of IPC.

The limitation of prosecution is "No court shall take cognizance of any offence punishable under this act except upon a complaint thereof is made by a person in this behalf within three months from the date of the occurrence of the alleged commission of the offence.

As per chapter VI of this act, these offences should be tried by Executive Magistrate, and is a cognizable and non-bailable offence.

Manual Scavenging and Social Issues

In India manual scavenging has existed since long. In recent survey it showed that it still exists in most of the states in India even after the passing of this act. As per the survey of the Govt. of Delhi Social welfare Department, it showed 32 manual scavengers in the city. These scavengers mainly belong to the lower castes of Hindu like Valmiki and muslims. The Delhi Govt. has taken initiatives to provide training to these workers in various skills for jobs and rehabilitate them.

Role of Treating Doctor and Autopsy Surgeon

Every case of mishaps due to sewage gas should be treated immediately in the emergency and a medicolegal report has to be prepared. It needs to be reported to the appropriate authority as it affects the public.

Proper history of the incidence from investigating officer, co-workers, relatives, eye wittiness and employer is essential. If possible visit the scene of occurrence by taking protective measures. During autopsy, observe the "rotten egg smell" from body (if possible) and note any injury over body. Conduct complete autopsy and look for signs of asphyxia externally and internally. Preserve the viscera and blood with preservatives to test for sewer gas poisons.

Conclusion

Sewage gas poisoning deaths are not uncommon in India. It is generally seen in cities where manual scavengers are employed to clean the sewage pipe or holes or sewage treatment plant tanks. The deaths are generally accidental due to lack of knowledge about toxicity of sewage gas and not taking adequate scientific precautions in the work place. It is also due to lack of scientific safety equipments in the work place. The victims are generally poor labourers of lower caste, who are hired to do this job. The Government needs to make the society aware about the toxicity of sewage gas and also implement strict guidelines of safety measure and employ safety scientific scavenging equipments to be used, instead of manual scavengers.

References

1. Singh A, Sharma BR, Hydrogen sulphide poisoning: a case report of quadruple fatalities. JPAFMAT 2008;8(1):38-40.
2. Letters to the Editor Hydrogen Sulfide Exposure as a Cause of Sudden Occupational. Arch Pathol Lab Med 2010 Aug;134.
3. Chemicals H, Sulfide H. Poison Facts/: High Chemicals/: Hydrogen Sulfide.
4. Hydrogen Sulfide (H_2S). ATSDR; CAS 7783-060-4/ ;UN 1053. :1-20.
5. Ramasamy S, Singh S, Taniere P, Langman MJS, Eggo MC. Sulfide-detoxifying enzymes in the human colon are decreased in cancer and upregulated in differentiation. 2018.pp.288-296. doi:10.1152/ajpgi.00324.2005.
6. Maebashi K, Iwadate K, Sakai K, et al. Toxicological analysis of 17 autopsy cases of hydrogen sulfide poisoning resulting from the inhalation of intentionally generated hydrogen sulfide gas. Forensic Sci Int. 2011;207(1-3):91-95. doi:10.1016/j.forsciint. 2010.09.008.
7. Kobayashi K, Fukushima H. [Suicidal poisoning due to hydrogen sulfide produced by mixing a liquid bath essence containing sulfur and a toilet bowl cleaner containing hydrochloric acid]. Chudoku Kenkyu. 2008;22(2):183-88.http://europepmc.org/abstract/MED/ 18516944.
8. Dust S, Control O. Superior Dust & Odor Control TECH NOTE/: Sewer Gas Health Risk Evaluation for Sewer Gas Tech Note. 1993;2(11).
9. States U. Find it in OSHA. 2018:2-3.
10. Prohibition of employment as Manual Scavengers and their Rehabilitation Act, 2013.
11. Prohibition of employment as Manual Scavengers and their Rehabilitation Rules, 2013.

Journal of Forensic Chemistry and Toxicology
Volume 4 Number 2, July - December 2018
DOI: http://dx.doi.org/10.21088/jfct.2454.9363.4218.4

Case Report

Sexual Jealousy Leads to Devil's Butchering: Case Report on Postmortem Mutilation

Dey Arijit*, Tyagi Swati*, Kanwar K. Hemant*, Sharma Neha*, Prasad Kulbhushan, Gupta K. Sudhir*****

Authors Affiliation: *Senior Resident **Assistant Professor ***Professor & Head, Department of Forensic Medicine & Toxicology, All India Institute of Medical Sciences, New Delhi, Delhi 110029, India.

Reprints Requests: Arijit Dey, Senior Resident, Department of Forensic Medicine, All India Institute of Medical Sciences, New Delhi, Delhi 110029, India.

E-mail: arijit.forensic@gmail.com

Received on 26.11.2018, **Accepted on** 15.12.2018

Abstract

A murderer may try several methods to dispose off or hide a dead body, so that his crime can remain undetected. The most frequently used methods include burial of corpse in an unusual or impervious place; charring the body beyond the state of recognition; dropping the weighted down body in the open sea or river; dismemberment of the body and further chemical treatment. Dismemberment is a relatively rare method in which, after killing the victim, the murderer uses a very sharp cutting heavy weapon (a saw, axe, meat chopper, etc.) to sever the limbs and cut the body into small pieces. This is generally done immediately after the crime, although a long time may pass between the two events. The dismembered body may then be further subjected to chemical treatment (acid digestion) that will result in non-identification of the deceased and hence non-discovery of the murderer. This presentation describes one such incident of dismemberment and mutilation of a dead body by the perpetrator, where the body was divided into 6 pieces and stored in a refrigerator, with the intention of disposing off the different segments in the near future by the perpetrator. Postmortem examination revealed the nature of weapon used to mutilate the corpse.

Keywords: Postmortem Mutilation; Homicide; Dismemberment; Sexual Jealousy.

Introduction

Sexual jealousy is a basic emotion. Although it lacks a distinctive facial expression and is unlikely to solve problems of survival, it evolved because it solves adaptive problems of mating sexual jealousy also leads to tremendous destruction, from humiliation to homicide [1]. The perpetrators act mostly with the aim of facilitating body removal,covering up the traces of the crime, and hindering identification (defensivemutilation). This is generally done immediately after the crime, although a long time may pass between the 2 events. More rarely, they are motivated byfactors such as aggression against the victim, (aggressive mutilation); dismemberment accompanying lust murders or necrosadistic murders (offensive mutilation); as well as winning a trophy or a fetish (necromaniac mutilation) [2]. In defensive mutilations, the perpetrator divides the body of the victim into pieces that allow for transporting the corpse and concealing it where it will not be noticed. In the majority of cases, the head and extremities are cut off the trunk, or the body is cut in halves across the trunk. Much less uncommonly, a forensic medicine expertcomes across a corpse divided into smaller parts, with fragmentation of the trunk and extremities. Such cases pose difficulties to a forensic expert, and often it is difficult to determine the cause of death and the mechanism by which fatal injuries were inflicted. The present case describes one such incident of aggressive mutilation of deceased due to sexual jealousy of the assailant and subsequent dismemberment of the dead body.

Case History

A 32 year old male was not appearing at his workplace for 3 days, following which his brother filed a missing complaint at nearest police station after which teams were formed to locate him. The

brother informed the police, that the deceased was close friends with his neighbor and he used to visit the place frequently. These two were also colleagues at the same workplace. When police reached his friend's home, it was locked from outside, and other residents of the building said that they have not seen him in the last 3 days. On breaking open the door, the room was empty and there was nothing suspicious around. Only, there was small amount of reddish fluid dribbling from below a partially opened refrigerator, inside which were several black polythene bags. The concerned Investigating Officer requested Head of Department, Department of Forensic Medicine & Toxicology, AIIMS, New Delhi for a scene of crime visit. On his intervention, one of the plastic bags was cut open with a blade and that bag was found to contain the severed head of a male human corpse. When the other plastic bags were opened, other parts of a dismembered human corpse were found inside them. These bags were removed and sent to AIIMS Mortuary for Postmortem examination.

Fig. 1: Refrigerator with black polythene bags showing body at the scene of crime

Postmortem Examination was conducted, which revealed that there was a swelling near right eye in peri-orbital region. There was slight greenish discoloration and peeling of the skin present on all the dismembered segments except the skull and face which was kept in the topmost freezer segment of the refrigerator. The body was dismembered into the following seven parts:

i. Skull & upper two cervical vertebrae with an incised wound at lower end.
ii. Chest and upper part of abdomen with both arms.
iii. Lower abdomen upto knee.
iv. Right leg extending from knee joint to the foot.
v. Left leg extending from knee joint up to foot with an incised wound at upper end.
vi. Right forearm extending from elbow joint up to the tip of fingers.
vii. Left forearm extending from elbow joint up to the tip of fingers.

None of these wounds showed any vital reaction, which meant that the body was dismembered after the person died, using a heavy weapon with a sharp cutting edge.

Fig. 2: Showing upper torso dismembered parts

Fig. 3: Showing lower torso dismembered parts

The following injuries were present, which were ante-mortem in nature, showing infiltration of the surrounding tissue along with vital reactions in the underlying tissue:

i. An incised wound of size 3 cm X 2 cm present over helix of right ear.
ii. An incised wound of size 5.6 cm X 2.6 cm, bone deep, margins of bone lined with clotted blood, placed obliquely over the right temporo-occipital region of skull 3 cm above the right mastoid process.
iii. An incised wound of size 6 cm X 1.7 cm, bone deep, margins of bone lined with clotted blood, placed obliquely over the right temporo-occipital region of skull 2 cm from injury no. ii.

iv. Multiple (4 in number) incised wounds present in an area of 10 cm X 7 cm, over the right side of face just below the right ear.

v. An incised wound of size 6.1 cm X 2.8 cm, muscle deep, placed vertically over the left side of face 2 cm lateral from outer margin of left eyebrow.

vi. An incised wound with surrounding reddish blue contusion of size 4 cm X 2 cm, muscle deep, placed obliquely over the lateral half of left eyebrow.

Fig. 4: Injuries over the Right side face

Fig. 5: Injuries over the Left side of face

On Internal Examination, upper parts of trachea and oesophagus were found to be missing.Internal contents of small intestine and large intestine were extruding out with putrefactive changes, as the torso was dismembered at the fifth lumbar vertebral level, with an incised wound.On dissection of scalp, sub-galeal haematoma was seen in an area of 10 cm X 9 cm with 40- 50 ml of clotted blood present underneath the injury over the right temporal region accompanied with fracture of the right parieto-temporal region of skull. On dissection of skull extra-dural haemorrhage in an area of 11 cm X 10 cm with clotted blood amounting to 120-150 ml was present over the right parieto-temporal region of skull. Rest of brain matter was congested with an intact base of skull. Time since death was opined to be about one week prior to postmortem examination. Cause of death was opined to be cranio-cerebral injury due to combined effect of multiple injuries over the skull from a sharp force impact. Dismemberment of the body was done postmortem.

Discussion

Dismemberment is a relatively rare method whereby after killing the victim, the murderer uses a very sharp cutting weapon (a saw, axe, meat chopper, etc) to sever the limbs and cut the body into small pieces, which is done usually immediately after the crime. Dismemberment of the corpse allows the murderer to clear the scene of the crime and also makes it easier for him to transport the body even for long distances, without raising any suspicion [3]. Postmortem mutilation is inflicted with different motives—indefensive mutilation, the reasonis to get rid of the body and make its identification more difficult; in aggressive mutilation, postmortem mutilation usually follows an act of outrageous killing of the victim [4]. Corpse dismembermentis associated with considerably strenuous physical effort and the offender usually restricts the dismemberment to the minimum, which isnecessary to conceal the corpse [5].

Internationally, the famous "Drum Murder case", "Ruxton case" and "The Baptist Church Cellar Murder case" are the major among other cases illustrated in medical literature of 20th century [6]. In the well-known Connecticut case of 1986, Richard Crafts destroyed the body of his wife using a wood chipper and after an exhaustive search at a nearby lake, the investigators recovered only a few fragments of human tissue [7]. Spitz has described the typical appearance at dismembered ends in bones, i.e. fragmentation of severed edges of long bones by axe, parallel- horizontal or oblique furrows in bone surface caused by skipping of saw blade [9]. In Indian context, a few cases have been reported by authors. Patowary and Barbhuiyan have reported a case in which scientific reconstruction of skeletal remnants helped the investigation to solve a gruesome murder, after superimposition, DNA typing and chemical analysis [9]. Reconstruction of injuries in a custodial death and other relevant findings were found to be useful by Mangal et al. [10] Garg has discussed about the importance of reconstruction in skeletonised human remains in solving a murder mystery of an unknown person who later was found to be dacoit killed by villagers [11]. Singh et al. has described a case where parts of a dismembered body

were submitted for investigation by police on a piecemeal basis, at intervals of few days, and a close comparison of the skeletal remains revealed that the different parts were of the same individual [12].

In the present case the accused and the victim were workplace colleagues: the former a butcher and the latter a bartender. The bartender had an illicit affair with the butcher's wife, and the husband caught them red handed one week prior to the incident. He planned the murder, out of sexual jealousy, and devised a plan to dispose the dead body. The alleged accused sent his wife to her maternal home and invited his friend to dinner and drinks. The victim was initially incapacitated by the injuries over the skull and face which finally lead to the death. In order to conceal and dispose the dead body, the accused dismembered it using his meat chopper into multiple pieces and preserved it in refrigerator. He planned to dispose these packets individually one by one, so that his butchering was not discovered. However, before he could dispose of the dismembered body, he fled from his house due to severe mental exhaustion after this ghastly crime, leaving behind the body in multiple packets inside the refrigerator. After crime scene visit by a Forensic Medicine expert and a thorough Postmortem examination were done, the police started their investigation and the culprit was caught from his relative's house within 48 hours, and he confessed to his crime. In this case, the detection of skull fractures and extradural hemorrhage could not have appeared after the victim's death, during the body dismemberment. These injuries had been caused by a hard, heavy & sharp cutting weapon. The pattern & site of injuries suggested that there was deliberate attempt to mutilate the body even after death. Multiple & repeated forceful inflictions indicated elements of deep anger, revenge & possibly anatomical knowledge by the assailant and an intention to dispose of the body secretly was evident.Intense sexual jealousy produced a murderous rage in the assailant and he committed this heinous crime.

Conclusion

The case illustrates importance of minute and detailed examination and reconstruction of mutilated segments of the body in order to establish identity and individuality of the person. From the nature of injuries, the weapon involved can also be detected. The accused committed this murder out of sexual jealousy against his wife and her paramour. In spite of dismemberment and decomposition of the corpse, a medicolegal examination allowed for determining not only the cause of death but also the mechanism by which the injuries had been inflicted.

Acknowledgement

Inspector Atul Kumar, Station House Officer, Mehrauli Police Station, New Delhi.

Conflict of Interest: None declared.

References

1. David M. Buss; Sexual Jealousy; Psychological Topics. 2013;22(2):155-82.
2. Rajs J, Lundstrom M, Broberg M, et al. Criminal mutilation of the human body in Sweden: a thirty-year medico-legal and forensic psychiatric study. J Forensic Sci. 1998;43:563–580.
3. Nunzio Di N, Fulvio C, Michele V and Cosimo Di N. Dismemberment—A Review of the Literature and Description of 3 Cases. The American Journal of Forensic Medicine and Pathology. 2006;27(4):307-312.
4. Bahadýr Kumral, Yalçýn Büyük, Ümit N. Gündoð muþ, EsatÞahin, M. FeyziÞahin. Medico-legal evaluation of deaths due to decapitation. Rom J Leg Med. 2012;20:251-54.
5. Tomasz Konopka, Filip Bolechala, Marcin Strona. An Unusual Case of Corpse Dismemberment. The American Journal of Forensic Medicine and Pathology. 2006;27(2):163-65.
6. Subrahmanyam B V. Modi's Medical Jurisprudence and Toxicology. 22nd edition. New Delhi:Butter worths India; 1999.pp.110- 122.
7. Lee H, O'Neil T. Cracking Cases: The Science of Solving Crimes. Amherst, NY: Prometheus Books; 2002.
8. Spitz WU. Spitz and Fisher's Medicolegal Investigation of death.3rd edition. Illinois: Charles C Thomas; 1993.pp.306-308.
9. Patowary AJ and Barbhuiyan SI. Bones unveiled gruesome murder. J Indian Acad Forensic Med. 2005; 27(1);53-54.
10. Mangal HM, PathakA and Rathod H. Reconstruction: A recipe of Forensic Medicine. J Indian Acad Forensic Med. 2007;29(2):74-75.
11. Garg SP. Reconstruction of body injuries leads to unraveling mystery behind unidentified mutilated skeletal human remains. J Indian Acad Forensic Med. 2007;29(1):35-37.
12. R.K. Singh, P.S. Thakur, N.M. Unda & G.L. Sodhi. Mutilated segments of human body in piece-meal: need for reconstruction and apositive opinion-A case report. J Indian Acad Forensic Med. 2019 Jan-March;31(1):47-50.

Case Report

Journal of Forensic Chemistry and Toxicology
Volume 4 Number 2, July - December 2018
DOI: http://dx.doi.org/10.21088/jfct.2454.9363.4218.5

Importance of Autopsy Report and Evidence Preservation in Judicial Conviction: An Illustration in a Rape and Murder Case

Abhishek Yadav*, Mohit Gupta, Asit Kumar Sikary***, Sudhir Kumar Gupta******

Authors Affiliation: *Assistant Professor ****Professor & Head, Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi, Delhi 110029, India. **Associate Professor, Department of Forensic Medicine and Toxicology, VMMC & Safdarjung Hospital, New Delhi, Delhi 110029, India. ***Assistant Professor, Department of Forensic Medicine and Toxicology, ESIC Medical College & Hospital, Faridabad, Haryana 121012, India.

Reprints Requests: Abhishek Yadav, Assistant Professor, Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi, Delhi 110029, India

E-mail: drayad_in@yahoo.com

Received on 14.09.2018, **Accepted on** 01.10.2018

Abstract

Autopsy examination includes external examination of body including injury description, internal examination, formulating opinion regarding cause of death and time since death. This is associated with evidence preservation, sealing and handing over to investigating officer for further analysis. Though this protocol of autopsy examination is well known to Autopsy surgeons, but they do not realize its importance during Judicial Proceedings. The authors report a case where careful evidence preservation during autopsy acted as a major ground in the conviction of accused and description of injuries aided in the decision of the quantum of Punishment. This case highlights the importance of even minor findings of the Autopsy report and their interpretation and correlation with the circumstances later on during the course of trial. The autopsy report can play a pivotal role in deciding the guilt of the accused and quantum of the Judgment, so they should be written with utmost precaution while maintaining highest unbiased scientific standards.

Keywords: Autopsy; Postmortem Examination; Evidence Preservation; DNA Profiling.

Introduction

Forensic Medicine particularly Autopsy examination has played a pivotal role in justice delivery. Many of the convictions have happened because of meticulous autopsy examination. Conventionally, autopsy examination includes external examination of body including injury description, internal examination, formulating opinion regarding cause of death and time since death [1,2,3]. This is associated with evidence preservation, sealing and handing over to investigating officer for further analysis. Though this protocol of autopsy examination is well known to Autopsy surgeons, but they do not realize its importance during Judicial Proceedings. There have been instances of inadvertent or careless mistakes like improper recording of autopsy findings and preservation of evidences recovered from body, which have resulted in creating confusion both in the minds of Judiciary and ultimately prevented the cases to reach to a logical conclusion [4,5]. Such instances also bring mistrust and lack of confidence over Autopsy procedures and Autopsy Surgeons. The authors report a case where careful evidence preservation during autopsy acted as a major ground in the conviction of accused and description of injuries aided in the decision of the quantum of punishment.

Case History

The semi clothed body of deceased was found at a desolate space in a nursery. She had been reported missing since previous evening after she left her workplace. The postmortem was conducted in Department of Forensic Medicine, All India Institute of Medical Sciences, New Delhi.

Autopsy Findings

The deceased was an average built female. Clothes on the upper part of body of deceased were folded upto the level of upper chest exposing upper half of right breast. The lower half of body was naked with wooden sticks found inserted into vaginal and anal canals. Both knees were drawn towards abdomen with flexion at hip and knee and tied passing around the back of neck with help of light bluish grey legging/pyjami. The loop encircling the neck was having two fixed knots and loop encircling the lower part of thigh had a single fixed knot. A reddish colored ligature material, legging/pyjami was found encircling neck in two loops having a single fixed knot on the right side of neck. Nail scrapings and nail clippings were preserved. Dried blood stains were present over the vulval and anal region. Conjunctival hemorrhage was present in both eyes. The following major external injuries were present on the body:

Ligature Mark

A reddish ligature mark of width varying from 2-2.5 cm was present at the middle 1/3rd of neck over the thyroid cartilage. The ligature mark was completely encircling the neck and placed horizontally (Image 1). Two hematomas of sizes 4 x 2 cm and 2 x 1 cm were present in neck muscles (Image 2). A hematoma of size 3 x 2 cm was present at the base of tongue (Image 3). Congestion was present in the pharyngeal region just above the level of the ligature mark externally. Petechiae were present on the laryngeal surface of the epiglottis. Thyrohyoid complex was intact. Laryngeal mucosa was congested.

The wooden stick present in the vaginal canal was extending from the vulva to the left kidney. It has entered the vaginal cavity causing contusion and multiple lacerations. It further perforated the anterior vaginal wall, peritoneal surface of urinary bladder, mesentery of small intestine in abdomen, posterior peritoneal wall on left side and finally lodged in the hilar region of the left kidney displacing the kidney upward and lacerating the hilar region (Image 4). The track of this wound was 34 cm long. Whole length of stick was 41 cm and the circumference of stick was 6.5 cm. A red colored underwear was recovered in the vaginal canal and has been sealed, signed and handed over to the police.

The wooden stick present in the anal canal was extending from the anus to the left kidney. It entered the anal cavity causing contusion, perforated the recto-sigmoid junction, mesentery of the small intestine in the abdomen, posterior abdominal wall on the left side and then was lodged in the hilar region of the left kidney displacing the kidney upward and lacerating the

Image 1: Ligature mark completely encircling the neck and placed horizontally

Image 2: Hematomas present in neck muscles

Image 3: Hematoma present at the base of tongue

hilar region (Image 4). The track of this wound was 32cm long. Whole length of stick was 43 cm and the circumference of stick was 6.5 cm.

Tracks of both the sticks in injury no. 9 and 10 were directed upward, backward and to the left and are associated with 1000 ml of fluid and clotted blood in the peritoneal cavity.

4. A laceration of size 1.5 x 0.8 cm was present over the mons pubis. Two lacerations of size 2 x 2 cm and 2 x 1.5 cm were present over the left and right side of upper part of the vaginal vestibule.
5. Multiple small lacerations of size varying from 0.5-1 cm were present circumferentially around the anal region at the level of sphincters.
6. A bluish contusion of size 1 x 1 cm was present over the left side of lower lip at the lower aspect (Image 5).

Image 4: Wooden sticks extending from the vulva to the left kidney

Image 5: Bluish contusion present over left side of lower lip

7. A reddish blue contusion of size 4 x 2 cm was present over the left ramus of the mandible near the midline along with another reddish blue contusion of size 2 x 1 cm along the lower border of left ramus of mandible.
8. A circular pressure contusion was present over the right ear lobule.
9. A linear laceration of size 1 cm was present over the lobule of the left ear.
10. A reddish crescentric abrasion (nail mark) of size 0.8 cm with concavity upwards was present 3 cm below the left ear.
11. A reddish grazed abrasion of size 6 x 6 cm was present over the interscapular region of the back in the midline.
12. A reddish curvilinear abrasion of size 15 x 0.2 cm was present over the outer aspect of right hip running downward and inward.
13. A reddish curvilinear abrasion of size 6 x 0.2 cm was present parallel and 1.5 cm medially along the lower half of above abrasion.

Diffuse petechiae were present below scalp over frontal and occipital region. Internal organs were pale. The cause of death was opined as the combined effect of ligature strangulation and shock due to visceral injuries and blood loss. The injuries no. 1, 2 and 3 individually and collectively were sufficient to cause death in the ordinary course of nature. The following items were preserved for trace evidence analysis:

1. Nail scrapings of both the hands
2. Clothing.
3. Swabs (Oral, Pharyngeal, vaginal, vulval, anal, inner thigh and control)
4. Blood on gauge.
5. Ligature material.
6. Cloth piece used to tie the legs.
7. Red underwear inserted into the Vaginal Cavity.
8. Wooden Stick inserted into the anus.
9. Wooden stick inserted into Vagina.
10. Vegetative material recovered from the clothes, vulval region and left hip region.

Discussion

After the postmortem examination, during the course of investigation a friend of the deceased was apprehended and charged for rape and murder. The examination of the accused was also conducted

in the Department of Forensic Medicine, AIIMS, New Delhi and his blood for DNA sample was preserved. The police alleged that he committed the crime as a result of jealousy as he was having an affair with the deceased but she had lately started avoiding him and wanted to discontinue their relationship. It was alleged by the persecution that he forcible committed rape upon her and throttled her neck with the red pyjami, which was also recovered from the neck region during autopsy. He deliberately inserted the wooden sticks in her private parts for the destruction of evidence. He took away her jewellery and other valuables to mislead the investigation. The DNA of the accused was detected from the seminal stain present on the shawl of the deceased recovered near the body from the crime scene and from red panty recovered from the vaginal canal during Postmortem examination [6].

The defense counsel for the accused disputed the DNA report countering that the police had tampered with evidence and put the semen sample of the accused on the articles while he was in their custody. Honorable court rejected their contention and observed that the article was preserved during the postmortem, sealed, handed over to IO in a sealed condition and was received in Central Forensic Science Laboratory (CFSL) in a properly sealed condition. Honorable court also observed that the blood sample, from which the DNA profile of the accused was generated, was taken and sealed during Medical examination of the accused in the Department on a separate date and time. The sealing and chain of custody was properly done from the Department till the submission in CFSL [6].

Honorable court while deciding regarding the guilt of accused made the following observation [6]:

1. The circumstances that the DNA profile of the accused was generated found on the underwear of the recovered from the vaginal cavity and on her shawl and the fact that the articles which the deceased was possessing on her person on the night of her death were recovered from the room of the accused establishes the guilt of the accused beyond all reasonable doubt and even if the prosecution has failed to prove that eye witness had witnessed the two of them together is not fatal to its case.
2. The fact that the accused had sexual intercourse with the deceased just before her death itself shows that she was last alive with him only.
3. The injuries present on the lips, mandible, ears, on the back in the midline, on the hip of the deceased indicate that all these injuries would have been caused to her while the accused was forcibly raping her.
4. The accused had abrasions, scratches and bite marks on his back, which does lead to an inference that the sexual intercourse that he had with the deceased on the night of was not consensual.
5. It is not only the penetration of penis into the vagina of a woman which constitutes rape but the insertion to any extent of any object into the vagina, urethra and anus of a woman also constitutes rape, thus the intentional act of the accused inserting wooden sticks into the vagina and anus of the deceased also constitutes rape.
6. The postmortem report of the deceased clearly reveals that injuries to her vagina and anus were antemortem in nature and clearly therefore the deceased was alive when the accused committed these ghastly acts upon her. It, therefore, cannot at all be accepted that the accused inserted wooden sticks into the vagina and anus of the deceased with a view to destroy evidence after she had died due to strangulation.
7. The postmortem report makes it clear that the strangulation of the deceased and the insertion of wooden sticks in her vagina and in her anus were both individually and collectively sufficient in the ordinary course to have caused her death. The said opinion of the doctors who conducted her postmortem and the provisions of section 376A IPC, make it thus clear that the injuries caused during the course of insertion of sticks into her vagina and anus also led to her death and therefore, the accused is liable to be convicted for the offence punishable under section 376A IPC.

The accused was convicted of the offences punishable under section 302, 376A, and 404 IPC and while deciding the punishment of the deceased, Honorable court made further observation [7]:

1. This court cannot overlook the fact that in the present case, the convict had inserted wooden sticks into the vagina and into the anus of the deceased prosecutrix which had led to excessive bleeding and the death of the prosecutrix and he had thereafter also strangulated her.

2. Such a diabolical act on the part of the convict does not deserve any leniency and has to be dealt with an iron hand.
3. Keeping in view the medical evidence and the state in which the body of the deceased was found, it is obvious that the convict in the present case committed a heinous type of rape and murder of a woman.

The accused was finally Imprisonment for life, for the offence punishable under section 302 IPC, and 376A IPC.

Conclusion

The present case report clearly indicates the importance of even minor findings of the Autopsy report and their interpretation and correlation with the circumstances later on during the course of trial. The Autopsy surgeons should be vigilant in the evidence preservation and sealing so as to maintain a proper chain of custody, else the analysis of the same can be disputed by the defense of the accused. The autopsy report can play a pivotal role in deciding the guilt of the accused and quantum of the Judgment, so they should be written with utmost precaution while maintaining highest unbiased scientific standards.

Conflict of Interests: Nil

Funding: Not required

References

1. Gupta SK, Yadav A. Mortuary Manual. Department of Forensic Medicine, AIIMS, New Delhi; 2018. Chapter-7; Postmortem examination: Page 35 to 39.
2. Justice K Kanan. Modi's Medical Jurisprudence and Toxicology. 25th ed. Lexis Nexis Butterworths, Gurugram; 2016. Chapter-13; Postmortem examination: page 285 to 328.
3. Reddy KSN, Murty OP. The Essentials of Forensic Medical Toxicology. 33th ed. K Suguna Devi, Hyderabad; 2014. Chapter-5; Medicolegal Autopsy: 102-133.
4. Dixit N. Shehla Masood case: Police, forensic doctors botched up probe. India Today. 2011 Oct 12. [Internet] [Cited 2018 Sep 14]. Available from: https://www.indiatoday.in/india/north/story/shehla-masood-case-police-forensic-doctors-botched-up-probe-143223-2011-10-12.
5. Narayana BK, MIshra AK, Honourable Allahbad High Court Justice. Rajesh Talwar & Nupura Talwar vs state of Uttar Pradesh. Criminal appeal no 293 & 294 of 2014. 2017 Oct 12.
6. Baliga AJ, Honorable Additional Sessions Judge. Judgment. State Vs Ramtej. SC No. 8429/2016, FIR No. 30/2015, PS Vasant Kunj (S), U/S 302/201/376A/392/411 IPC. 2018 May 02.
7. Baliga AJ, Honorable Additional Sessions Judge. Order on sentence. State Vs Ramtej. SC No. 8429/2016, FIR No. 30/2015, PS Vasant Kunj (S), U/S 302/201/376A/392/411 IPC. 2018 May 30.

SUBSCRIPTION FORM

I want to renew/subscribe international class journal **"Pediatric Education and Research"** of Red Flower Publication Pvt. Ltd.

Subscription Rates:
- Institutional: INR7500/USD430

Name and complete address (in capitals): _____

_____

Payment detail:
Online payment link: http://rfppl.co.in/payment.php?mid=15

Cheque/DD: Please send the US dollar check from outside India and INR check from India made payable to 'Red Flower Publication Private Limited'. Drawn on Delhi branch.

Wire transfer/NEFT/RTGS:
Complete Bank Account No. 604320110000467
Beneficiary Name: Red Flower Publication Pvt. Ltd.
Bank & Branch Name: Bank of India; Mayur Vihar
MICR Code: 110013045
Branch Code: 6043
IFSC Code: BKID0006043 (used for RTGS and NEFT transactions)
Swift Code: BKIDINBBDOS

Term and condition for supply of journals
1. Advance payment required by Demand Draft payable to Red Flower Publicaion Pvt. Ltd. payable at Delhi.
2. Cancellation not allowed except for duplicate payment.
3. Agents allowed 10% discount.
4. Claim must be made within six months from issue date.

Mail all orders to
Subscription and Marketing Manager
Red Flower Publication Pvt. Ltd.
48/41-42, DSIDC, Pocket-II
Mayur Vihar Phase-I
Delhi - 110 091(India)
Mobile: 8130750089, Phone: 91-11-45796900, 22754205, 22756995
E-mail: sales@rfppl.co.in, Website: http://www.rfppl.co.in

Journal of Forensic Chemistry and Toxicology
Volume 4 Number 2, July - December 2018
DOI: http://dx.doi.org/10.21088/jfct.2454.9363.4218.6

Case Report

Long Drop Suicidal Hanging with Autopsy Finding of Cervical Spine Fracture: A Rare Case Report

Sharma Neha*, Dey Arijit*, Tyagi Swati*, Pandit N. Jay*, Prasad Kulbhushan, Gupta K. Sudhir*****

Authors Affiliation: *Resident **Assistant Professor ***Professor & Head, Department of Forensic Medicine & Toxicology, All India Institute of Medical Sciences, New Delhi, Delhi 110029, India.

Reprints Requests: Arijit Dey, Senior Resident, Department of Forensic Medicine & Toxicology, All India Institute of Medical Sciences, New Delhi, Delhi 110029, India.

E-mail: arijit.forensic@gmail.com

Received on 26.11.2018, **Accepted on** 15.12.2018

Abstract

Cervical fracture is a rare presentation in suicidal hanging but a common finding in judicial hanging where the person is dropped from a calculated height, resulting in fracture dislocation at the level of 2^{nd}-3^{rd} or 3^{rd}-4^{th} cervical vertebrae. In case of long drop hanging cervical fracture with or without dislocation is commonly found; possibly due toa greater tractional force due to longer height of suspension. We describe acase of an average built male weighing 72 kg who hanged himself by jumping off a roof top, with a drop length of 4.14m. On autopsy in addition to common findings of a hanging case, complete transection ofspinal cord and fracture dislocation of cervical vertebrae C2-C3 were found along with hematoma. In this case of long drop hanging, there was fracture of cervical spine with ligature knot being placed at sub-occipital position which is a rare autopsy finding.

Keywords: Hangman's Fracture; Long Drop; Sub-Occipital Knot; Suicidal Hanging.

Introduction

Suicide rate has been alarmingly high globally as well as in India especially in the urban region. Hanging remains to be the widely followed method of suicide except in few countries like United States of America where firearms are used more commonly. In India, hanging is used most commonly as a suicidemethod among males and females especially in 20 - 35 years of age, while the occurrence is less among children and elderly [1]. Hanging is the form of mechanical asphyxia where the body is suspended by a ligature around the neck, the constricting force being the weight of the body or weight of a part of the body [2]. It can be complete where feet are off ground or incomplete/ partial where feet touch ground or any support. Most of the cases reported are of atypical hanging i.e. knot is placed at position over the neck other than nape of neck; and typical hanging is the one in which knot is placed over the nape of the neck. Most of the cases reported of complete hanging are of short drop i.e. height not more than 2 meters and rarely do we find a case of long drop where the height of fall is above 2 meter (may range over 6 meters). This is commonly seen in judicial hanging. A typical finding associated with such long drop is fracture of the cervical vertebra commonly known as hangman's fracture [3-8]. The most common pattern of cervical spine injury includes anterior longitudinal ligament disruption of the lower cervical spine, disk space widening, and no vertebral body displacement. We discuss a case of long drop suicidal hanging by an elderly person, who jumped off the roof of a building, with a jute rope as a ligature material and whose postmortem examination revealed fracture-dislocation of upper cervical vertebra and associated spinal cord injury.

Case Details

A 68 years old male was found in completely hanged position with a jute rope as a ligature material, at his residence and the height of suspension was about 6.5 m from the knot. The dead body was removed from the hanging position and was taken to AIIMS casualty where he was declared brought dead. Suicide notes written on a

piece of paper and also over the shirts worn were recovered (Fig. 1,2).

Fig. 1:

Fig. 2:

Autopsy was conducted in the mortuary of Department of Forensic Medicine & Toxicology, AIIMS, New Delhi and the findings were as under-

External Examination

Deceased was moderately built with length 167 cm and weighing 72kg. Rigor mortis was well developed; postmortem lividity was fixed and present in glove and stockings distribution. Both eyes and mouth were closed. Ligature material was a grey colour braided thick jute rope present encircling the neck in two loops with a single running knot. The knot was present over lateral aspect of neck. The circumference of noose including the knot was 32 cm. There were three free ends emerging from the knot which were 414cm, 10 cm and 14 cm long.

Ligature mark- Ligature mark was reddish brown colour, incomplete, parchmentised, in upper half of antero-lateral aspect of neck, directed oblique, upwards and backwards merging with posterior hairline and nape of neck. It was 4 cm below mentum and 11 cm above suprasternal notch, 4 cm wide with intervening normal skin. Laterally it was 1 cm below left mastoid process and 3 cm below right mastoid process. Width of the mark was 2.5 cm on both left and right lateral aspect of neck. Total circumference of the ligature mark was 32 cm.

The other injuries on the body included-

i. Reddish colour abrasion of size 5 cmX 0.8 cm placed horizontally over the chin across midline.

ii. Lacerated wound of size 4 cm X 0.5 cm placed horizontally on right side of forehead 4.5 cm above the eyebrow at midline; on dissection underlying sub-scalp hematoma was present.

iii. Two reddish abrasion of size 1cmX 0.5 cm and 1cm X 0.4 cm present at outer aspect of base of right thumb.

Fig. 3: Ligature material

Internal Examination

On dissection of neck, the tissue underlying the ligature mark was dry, pale, glistening, devoid of any extravasation or hematoma. The cervical vertebra along with spinal cord at the level of C2 and C3 vertebra was completely transected and associated with hematoma in surrounding area. The thyrohyoid complex was intact. The tracheal mucosa was congested. All other visceral organs were congested. Stomach was filled with partially digested food matter with no characteristic smell. The cause of death was declared as 'Shock due to injury sustained to cervical vertebra at the level of C2 and C3, in a case of antemortem hanging' (Fig. 3,4,5).

Fig. 4: External neck injury

Fig. 5: Internal neck injury

Discussion

Cervical fracture by hanging is a rare finding and mostly seen in long drop suspensions [9]. Schneider et al. in 1965 coined the term Hangman's Fracture to describe cervical vertebrae injuries following a series of car accidents where there was bilateral avulsion of the neural arch of the axis (C2) from vertebral body with or without dislocation of the C2 vertebral body on C3, due to similarity to cervical fracture observed after judicial hanging as a sequel to violent and rapid hyperextension of the head [10]. Anterior aspect of the neck is vulnerable to any mechanical compression as the veins, arteries and nerves are easily compressible. The posterior aspect of the neck is partially protected by the cervical vertebra, but these are also not spared from injuries. Whenever the length of fall is longer than the height of the victim, it will cause injury to the cervical vertebra due to the axial, gravitational force and torsion of the neck. In judicial hanging, height of the person is measured and then he is suspended at a height more than the height of victim. Greater the height and weight of the person, greater is the profoundness of injury. In judicial hanging there is usually a long drop in order to lead to instantaneous death caused by fracture of the upper cervical spine which results in a corresponding spinal cord injury [11,12]. Nokes et al. summarized the past studies on judicial hanging cases and suggested that the amount of energy needed around the neck to produce instantaneous unconsciousness with cervical fracture, dislocation, fatal spine cord and brainstem disruption without decapitation is approximately 1,700 J, which is calculated using the formula, Body weight (kg) X 9.81(m/s^2) X drop height (m) [13].

In the present case the victim was an elderly man who jumped off a rooftop by tying bedsheet with suboccipital knot around the neck, free ends of ligature or the drop was 4.14 m in length; which was much greater than his own height, producing tractional force more than sufficient to cause instantaneous death and complete transaction of spinal cord at the level of cervical vertebrae C2 and C3 along with hematoma. A typical hangman's fracture is fracture of cervical spine at the isthmus of the axis caused by retro flexion in combination with anteroflexion of the head in hanging with a long drop and a sub mental knot [14,15]. But Fabrice Dedouit et al. reported a case of complete post hangingdecapitation wherethe cervical spine broke between the third and the fourth cervical vertebrae with fractures of extremities of the spinous processes of the 2nd and 3rd cervical

vertebrae with no fracture in the region of isthmus. The spinal fractures occurred due to the combination of axial traction, shearing force and crushing forces [16]. In the study conducted by Nikolic´ et al. cervical spine injuries were identified in only 3.3% of short-drop hangings and 80% of subjects with cervical fracture were aged 66.5 years and above. Fracture commonly involved lower cervical spine injury in association with disruption of anterior longitudinal ligament with disk space widening and no displacement. These injuries mainly occurred with an anterior knot position due to pressure on the posterior neck and cervical spine hyperextension[17].In a retrospective study conducted by James and Nasmyth-Jones in 1992 on 34 persons judicially hanged, only six had fracture to the axis and one had cervical osseous fracture; the results indicating that traditional hangman's fracture occurred in only a small proportion of cases of judicial hanging [18]. Takahito Hayashi etal conducted a prospective autopsy study using postmortem multislice computed tomography (pmMSCT) visualizing hangman's fractures in 1 case (3.1%) of 32 cases of hanging where longer drop with a lateral knot was used [19]. Ghormade et al. reported a similar case of cervical fracture by long drop (6.3 m) using a nylon rope and sub occipital position of knot, and deep laceration was present over anterolateral aspect of neck [20].

In the present case there is long drop (4.14 m), sub occipital position of knot and cervical fracture without any laceration over the neck; possibly due to use of bedsheet as ligature material which is softer as compared to nylon rope. In the present case, the deceased fell down from a distance of 4.14 m before suspension and constriction by therope. Usually, in such long drops, there is every chanceof partial or complete decapitation due to traction force. However, there was fracture dislocation of Cervical 2nd and 3rd vertebrae along with complete transection of spinal cord. The deceased was an average built person with body weight 72kg, which was insufficient to cause enough gravitational pull, thus preventing decapitation even after sufficient traction. Perhaps, the deceased jumped from the edge of the roof top after tightening the rope, which is sufficiently high up to cause sudden twist of the neck before suspension along with gravitational pull due to positional effect. This movement at the time of suspension was probably responsible for the Cervical fracture & dislocation.

Conclusion

Fracture of cervical vertebrae is not a common finding in suicidal hanging and is mostly seen in judicial hanging associated with long drop. Even in long drop hangings, cervical fracture are commonly found among elderly, possibly due to osteoporotic changes in the vertebrae. The findings in this case are consistent with the observation, complete transaction of C2 and C3 was seen in an elderly male after suspension from height more than 6 meter.

References

1. http://www.ncrb.gov.in/.Internet. Accessed on 5.10.2018.
2. Knight B. Forensic Pathology. Suffocation and Asphyxia. 2nd ed. London: Arnold; 1996.p.346.
3. Aggarwal A. Textbook of Forensic Medicine and Toxicology. 1sted. New Delhi: Avichal Publishing Company; 2014.p.366-392.
4. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 25th Ed. Hyderabad: K Suguna Devi; 2006.p.297-331.
5. Pillay VV. Textbook of Forensic Medicine and toxicology. 17th Ed. Hyderabad: Paras Medical Publisher; 2016.p.296-325.
6. Vij K. Textbook of Forensic Medicine and Toxicology: Principles and Practice. 5thed. New Delhi: Elsevier India Pvt Ltd; 2011.p.110-45.
7. Nandy A. Principle of Forensic Medicine including Toxicology. 3rded India: Central Book Agency; 2010. p.517-18.
8. Mahanta P. Modern Textbook of Forensic medicine & Toxicology. New Delhi: Jaypee Brothers: 2014.p. 340-60.
9. Suárez-Peñaranda JM, Alvarez T, Miguéns X, Rodríguez-Calvo MS, de Abajo BL, Cortesão M, Cordeiro C, Vieira DN, Muñoz JI. Characterization of lesions in hanging deaths. J Forensic Sci. 2008; 53:720–3.
10. Schneider RC, Livingston KE, Cave AJE, Gilbert H. "Hangman's fracture" of the cervical spine. J Neurosurg. 1965;22:141–54.
11. Spence MW, Shkrum MJ, Ariss A, Regan J. Craniocervical injuries in judicial hangings: an anthropologic analysis of six cases. Am J Forensic Med Pathol. 1999;20:309–22.
12. Rayes M, Mittal M, Rengachary SS, Mittal S. Hangman's fracture: a historical and biomechanical perspective. J Neurosurg Spine. 2011;14:198–208.

13. Nokes LD, Roberts A, James DS. Biomechanics of judicial hanging: a case report. Med Sci Law. 1999; 39:61–4.
14. Sköld G. Fracture of the axis caused by hanging. Z Rechtsmed 1978;80(4):329–31.
15. Saternus KS. Verletzung der Halswirbelsäulebeim SuiziddurchErhängen. Z Rechtsmed 1978;81: 299–308.
16. FabriceDedouit, Gilles Tournel, Anne Bécart, Valéry Hédouin, Didier Gosset. Suicidal Hanging Resulting in Complete Decapitation––Forensic, Radiological, and Anthropological Studies: A Case Report. J Forensic Sci. 2007;52(5);1190-93.
17. Slobodan Nikolic´, Vladimir Z¡ Ivkovic. Cervical spine injuries in suicidal hanging without a long-drop—patterns and possible underlying mechanisms of injury: an autopsy study. Forensic Sci Med Pathol 2014;10:193–97.
18. James R. and Nasmyth-Jones R. The occurrence of cervical fractures in victims of judicial hanging. Forensic. Sci. Int. 1992;54(1):81–91.
19. Takahito Hayashi, Sven Hartwig, Michael Tsokos, Lars Oesterhelweg. Postmortem multislice computed tomography (pm MSCT) imaging of hangman's fracture; Forensic Sci Med Pathol. 2014;10:3–8
20. Pankaj Suresh Ghormade,Bedanta Sarma, Sandeep Gajbhiye. Sub-occipital ligature knot in a case of long drop suicidal hanging with rare autopsy finding of cervical spine fracture. Egyptian Journal of Forensic Sciences 2018;8:31.

Guidelines for Authors

Manuscripts must be prepared in accordance with "Uniform requirements for Manuscripts submitted to Biomedical Journal" developed by international committee of medical Journal Editors.

Types of Manuscripts and Limits

Original articles: Up to 3000 words excluding references and abstract and up to 10 references.

Review articles: Up to 2500 words excluding references and abstract and up to 10 references.

Case reports: Up to 1000 words excluding references and abstract and up to 10 references.

Online Submission of the Manuscripts

Articles can also be submitted online from http://rfppl.co.in/customer_index.php.

I) First Page File: Prepare the title page, covering letter, acknowledgement, etc. using a word processor program. All information which can reveal your identity should be here. use text/rtf/doc/PDF files. Do not zip the files.

2) Article file: The main text of the article, beginning from Abstract till References (including tables) should be in this file. Do not include any information (such as acknowledgement, your name in page headers, etc.) in this file. Use text/rtf/doc/PDF files. Do not zip the files. Limit the file size to 400 Kb. Do not incorporate images in the file. If file size is large, graphs can be submitted as images separately without incorporating them in the article file to reduce the size of the file.

3) Images: Submit good quality color images. Each image should be less than 100 Kb in size. Size of the image can be reduced by decreasing the actual height and width of the images (keep up to 400 pixels or 3 inches). All image formats (jpeg, tiff, gif, bmp, png, eps etc.) are acceptable; jpeg is most suitable.

Legends: Legends for the figures/images should be included at the end of the article file.

If the manuscript is submitted online, the contributors' form and copyright transfer form has to be submitted in original with the signatures of all the contributors within two weeks from submission. Hard copies of the images (3 sets), for articles submitted online, should be sent to the journal office at the time of submission of a revised manuscript. Editorial office: Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091, India, Phone: 91-11-22754205, 45796900, 22756995. E-mail: author@rfppl.co.in. Submission page: http://rfppl.co.in/article_submission_system.php?mid=5.

Preparation of the Manuscript

The text of observational and experimental articles should be divided into sections with the headings: Introduction, Methods, Results, Discussion, References, Tables, Figures, Figure legends, and Acknowledgment. Do not make subheadings in these sections.

Title Page

The title page should carry

1) Type of manuscript (e.g. Original article, Review article, Case Report)
2) The title of the article, should be concise and informative;
3) Running title or short title not more than 50 characters;
4) The name by which each contributor is known (Last name, First name and initials of middle name), with his or her highest academic degree(s) and institutional affiliation;
5) The name of the department(s) and institution(s) to which the work should be attributed;
6) The name, address, phone numbers, facsimile numbers and e-mail address of the contributor responsible for correspondence about the manuscript; should be mentoined.
7) The total number of pages, total number of photographs and word counts separately for abstract and for the text (excluding the references and abstract);
8) Source(s) of support in the form of grants, equipment, drugs, or all of these;
9) Acknowledgement, if any; and
l0) If the manuscript was presented as part at a meeting, the organization, place, and exact date on which it was read.

Abstract Page

The second page should carry the full title of the manuscript and an abstract (of no more than 150 words for case reports, brief reports and 250 words for original articles). The abstract should be structured and state the Context (Background), Aims, Settings and Design, Methods and Materials, Statistical analysis used, Results and Conclusions. Below the abstract should provide 3 to 10 keywords.

Introduction

State the background of the study and purpose of the study and summarize the rationale for the study or observation.

Methods

The methods section should include only information that was available at the time the plan or protocol for the study was written such as study approach, design, type of sample, sample size, sampling technique, setting of the study, description of data collection tools and methods; all information obtained during the conduct of the study belongs in the Results section.

Reports of randomized clinical trials should be based on the CONSORT Statement (http://www. consort-statement. org). When reporting experiments on human subjects, indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000 (available at http:// www.wma.net/e/policy/l 7-c_e.html).

Results

Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text; alternatively, it can be published only in the electronic version of the journal.

Discussion

Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

References

List references in alphabetical order. Each listed reference should be cited in text (not in alphabetic order), and each text citation should be listed in the References section. Identify references in text, tables, and legends by Arabic numerals in square bracket (e.g. [10]). Please refer to ICMJE Guidelines (http://www.nlm.nih.gov/bsd/uniform_ requirements.html) for more examples.

Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O, Kidd EAM,

editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

More information about other reference types is available at www.nlm.nih.gov/bsd/uniform_requirements.html, but observes some minor deviations (no full stop after journal title, no issue or date after volume, etc).

Tables

Tables should be self-explanatory and should not duplicate textual material.

Tables with more than 10 columns and 25 rows are not acceptable.

Table numbers should be in Arabic numerals, consecutively in the order of their first citation in the text and supply a brief title for each.

Explain in footnotes all non-standard abbreviations that are used in each table.

For footnotes use the following symbols, in this sequence: *, ¶, †, ‡‡,

Illustrations (Figures)

Graphics files are welcome if supplied as Tiff, EPS, or PowerPoint files of minimum 1200x1600 pixel size. The minimum line weight for line art is 0.5 point for optimal printing.

When possible, please place symbol legends below the figure instead of to the side.

Original color figures can be printed in color at the editor's and publisher's discretion provided the author agrees to pay.

Type or print out legends (maximum 40 words, excluding the credit line) for illustrations using double spacing, with Arabic numerals corresponding to the illustrations.

Sending a revised manuscript

While submitting a revised manuscript, contributors are requested to include, along with single copy of the final revised manuscript, a photocopy of the revised manuscript with the changes underlined in red and copy of the comments with the point to point clarification to each comment. The manuscript number should be written on each of these documents. If the manuscript is submitted online, the contributors' form and copyright transfer form has to be submitted in original with the signatures of all the contributors within two weeks of submission. Hard copies of images should be sent to the office of the journal. There is no need to send printed manuscript for articles submitted online.

Reprints

Journal provides no free printed reprints, however a author copy is sent to the main author and additional copies are available on payment (ask to the journal office).

Copyrights

The whole of the literary matter in the journal is copyright and cannot be reproduced without the written permission.

Declaration

A declaration should be submitted stating that the manuscript represents valid work and that neither this manuscript nor one with substantially similar content under the present authorship has been published or is being considered for publication elsewhere and the authorship of this article will not be contested by any one whose name (s) is/are not listed here, and that the order of authorship as placed in the manuscript is final and accepted by the co-authors. Declarations should be signed by all the authors in the order in which they are mentioned in the original manuscript. Matters appearing in the Journal are covered by copyright but no objection will be made to their reproduction provided permission is obtained from the Editor prior to publication and due acknowledgment of the source is made.

Approval of Ethics Committee

We need the Ethics committee approval letter from an Institutional ethical committee (IEC) or an institutional review board (IRB) to publish your Research article or author should submit a statement that the study does not require ethics approval along with evidence. The evidence could either be consent from patients is available and there are no ethics issues in the paper or a letter from an IRB stating that the study in question does not require ethics approval.

Abbreviations

Standard abbreviations should be used and be spelt out when first used in the text. Abbreviations should not be used in the title or abstract.

Checklist

- Manuscript Title
- Covering letter: Signed by all contributors
- Previous publication/ presentations mentioned, Source of funding mentioned
- Conflicts of interest disclosed

Authors

- Middle name initials provided.
- Author for correspondence, with e-mail address provided.
- Number of contributors restricted as per the instructions.
- Identity not revealed in paper except title page (e.g. name of the institute in Methods, citing previous study as 'our study')

Presentation and Format

- Double spacing
- Margins 2.5 cm from all four sides
- Title page contains all the desired information. Running title provided (not more than 50 characters)
- Abstract page contains the full title of the manuscript
- Abstract provided: Structured abstract provided for an original article.
- Key words provided (three or more)
- Introduction of 75-100 words
- Headings in title case (not ALL CAPITALS). References cited in square brackets
- References according to the journal's instructions

Language and grammar

- Uniformly American English
- Abbreviations spelt out in full for the first time. Numerals from 1 to l0 spelt out
- Numerals at the beginning of the sentence spelt out

Tables and figures

- No repetition of data in tables and graphs and in text.
- Actual numbers from which graphs drawn, provided.
- Figures necessary and of good quality (color)
- Table and figure numbers in Arabic letters (not Roman).
- Labels pasted on back of the photographs (no names written)
- Figure legends provided (not more than 40 words)
- Patients' privacy maintained, (if not permission taken)
- Credit note for borrowed figures/tables provided
- Manuscript provided on a CDROM (with double spacing)

Submitting the Manuscript

- Is the journal editor's contact information current?
- Is the cover letter included with the manuscript? Does the letter:

1. Include the author's postal address, e-mail address, telephone number, and fax number for future correspondence?
2. State that the manuscript is original, not previously published, and not under concurrent consideration elsewhere?
3. Inform the journal editor of the existence of any similar published manuscripts written by the author?
4. Mention any supplemental material you are submitting for the online version of your article. Contributors' Form (to be modified as applicable and one signed copy attached with the manuscript)

Subject Index

Author Index

Revised Rates for 2019 (Institutional)

Title of the Journal	Frequency	India(INR) Print Only	India(INR) Online Only	Outside India(USD) Print Only	Outside India(USD) Online Only
Community and Public Health Nursing	Triannual	5500	5000	430	391
Dermatology International	Semiannual	5500	5000	430	391
Gastroenterology International	Semiannual	6000	5500	469	430
Indian Journal of Agriculture Business	Semiannual	5500	5000	413	375
Indian Journal of Anatomy	Bi-monthly	8500	8000	664	625
Indian Journal of Ancient Medicine and Yoga	Quarterly	8000	7500	625	586
Indian Journal of Anesthesia and Analgesia	Monthly	7500	7000	586	547
Indian Journal of Biology	Semiannual	5500	5000	430	391
Indian Journal of Cancer Education and Research	Semiannual	9000	8500	703	664
Indian Journal of Communicable Diseases	Semiannual	8500	8000	664	625
Indian Journal of Dental Education	Quarterly	5500	5000	430	391
Indian Journal of Diabetes and Endocrinology	Semiannual	8000	7500	597	560
Indian Journal of Emergency Medicine	Bi-Monthly	12500	12000	977	938
Indian Journal of Forensic Medicine and Pathology	Quarterly	16000	15500	1250	1211
Indian Journal of Forensic Odontology	Semiannual	5500	5000	430	391
Indian Journal of Genetics and Molecular Research	Semiannual	7000	6500	547	508
Indian Journal of Hospital Administration	Semiannual	7000	6500	547	508
Indian Journal of Hospital Infection	Semiannual	12500	12000	938	901
Indian Journal of Law and Human Behavior	Tri-Annual	6000	5500	469	430
Indian Journal of Legal Medicine	Semiannual	8500	8000	607	550
Indian Journal of Library and Information Science	Triannual	9500	9000	742	703
Indian Journal of Maternal-Fetal & Neonatal Medicine	Tri-Annual	9500	9000	742	703
Indian Journal of Medical & Health Sciences	Semiannual	7000	6500	547	508
Indian Journal of Obstetrics and Gynecology	Bi-monthly	9500	9000	742	703
Indian Journal of Pathology: Research and Practice	Monthly	12000	11500	938	898
Indian Journal of Plant and Soil	Semiannual	6500	6000	508	469
Indian Journal of Preventive Medicine	Semiannual	7000	6500	547	508
Indian Journal of Research in Anthropology	Semiannual	12500	12000	977	938
Indian Journal of Surgical Nursing	Triannual	5500	5000	430	391
Indian Journal of Trauma and Emergency Pediatrics	Quarterly	9500	9000	742	703
Indian Journal of Waste Management	Semiannual	9500	8500	742	664
International Journal of Food, Nutrition & Dietetics	Triannual	5500	5000	430	391
International Journal of Neurology and Neurosurgery	Quarterly	10500	10000	820	781
International Journal of Pediatric Nursing	Triannual	5500	5000	430	391
International Journal of Political Science	Semiannual	6000	5500	450	413
International Journal of Practical Nursing	Triannual	5500	5000	430	391
International Physiology	Triannual	7500	7000	586	547
Journal of Animal Feed Science and Technology	Semiannual	7800	7300	609	570
Journal of Cardiovascular Medicine and Surgery	Quarterly	10000	9500	781	742
Journal of Forensic Chemistry and Toxicology	Semiannual	9500	9000	742	703
Journal of Global Medical Education and Research	Semiannual	5900	5500	440	410
Journal of Global Public Health	Semiannual	12000	11500	896	858
Journal of Microbiology and Related Research	Semiannual	8500	8000	664	625
Journal of Nurse Midwifery and Maternal Health	Triannual	5500	5000	430	391
Journal of Orthopedic Education	Triannual	5500	5000	430	391
Journal of Pharmaceutical and Medicinal Chemistry	Semiannual	16500	16000	1289	1250
Journal of Plastic Surgery and Transplantation	Semiannual	26400	25900	2063	2023
Journal of Practical Biochemistry and Biophysics	Semiannual	7000	6500	547	508
Journal of Psychiatric Nursing	Triannual	5500	5000	430	391
Journal of Social Welfare and Management	Triannual	7500	7000	586	547
New Indian Journal of Surgery	Monthly	8000	7500	625	586
Ophthalmology and Allied Sciences	Quarterly	6000	5500	469	430
Otolaryngology International	Semiannual	5500	5000	430	391
Pediatric Education and Research	Triannual	7500	7000	586	547
Physiotherapy and Occupational Therapy Journal	Quarterly	9000	8500	703	664
RFP Indian Journal of Medical Psychiatry	Semiannual	8000	7500	625	586
RFP Journal of Gerontology and Geriatric Nursing	Semiannual	5500	5000	430	391
Urology, Nephrology and Andrology International	Semiannual	7500	7000	586	547

Terms of Supply:

1. Agency discount 12.5%. Issues will be sent directly to the end user, otherwise foreign rates will be charged.
2. All back volumes of all journals are available at current rates.
3. All Journals are available free online with print order within the subscription period.
4. All legal disputes subject to Delhi jurisdiction.
5. Cancellations are not accepted orders once processed.
6. Demand draft / cheque should be issued in favour of "Red Flower Publication Pvt. Ltd." payable at Delhi
7. Full pre-payment is required. It can be done through online (http://rfppl.co.in/subscribe.php?mid=7).
8. No claims will be entertained if not reported within 6 months of the publishing date.
9. Orders and payments are to be sent to our office address as given above.
10. Postage & Handling is included in the subscription rates.
11. Subscription period is accepted on calendar year basis (i.e. Jan to Dec). However orders may be placed any time throughout the year.

Order from
Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi - 110 091 (India),
Mobile: 8130750089, Phone: 91-11-45796900, 22754205, 22756995 E-mail: sales@rfppl.co.in, Website: www.rfppl.co.in