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From Editor's Desk

First of all I thank you very much for the love and affection which you have showered upon me at Goa and given me the responsibility of bringing to you this prestigious journal of India regularly to you. I assure you that I will leave no stone unturned to maintain and raise the standard of the Journal of Indian Academy of Forensic Medicine. At this moment I promise you to bring all the issues in time. I seek your valuable suggestions and cooperation in this humble endeavor. Your critical evaluation of my work will be always appreciated. I thank the advertisers who are generous enough to provide me the required funds for this journal to disseminate the latest scientific knowledge to all of you. I thank Dr. G.S. Nagpal from Bathinda, Dr. Amandeep Singh from Kharar and State Bank of Patiala for helping generously to publish this issue. I seek your forgiveness in taking the liberty of sharing my thoughts on the current topics with you. This time I am sharing my views on bioterrorism. I thank all my departmental colleagues who have rendered me whole hearted help to make my work easy. Here I would like particularly to mention the name of Dr. Akash Deep Aggarwal who spent a lot of time on the computer with me to make this project successful.

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BIOTERRORISM - THE LATEST FRIGHT FOR THE PRESENT GENERATION

In this universe there are many types of weapons of mass destruction developed by various countries e.g. nuclear weapons, chemical weapons and biological weapons in addition to the conventional weapons. Terrorists can get control of any of these weapons and can cause havoc. Sometimes they develop weapons particularly for causing panic rather than destruction like dirty bombs. Dirty bombs are conventional bombs but also contain nuclear waste. On detonation nuclear waste is spread and people get panicky that bomb is nuclear though small amount of nuclear material may not cause damage more than a single exposure of the person for routine x-ray examination. In this chapter we will limit ourselves to biological warfare and bioterrorism, which is a powerful tool in the hands of the states and terrorists. History dates back to the eighteenth century (1754 – 1767) when British colonial commanders distributed blankets used by small pox patients to the Native Americans and the mortality in some tribes was as high as 50%. Japanese army also used smallpox weapon against the Mongolians and Chinese during the Second World War. Brucella suis was the first agent to be weaponized as a biological weapon by the U.S. in 1954. Terrorists are using the conventional means of destruction but there are chances that unprotected biological weapons may get into the hands of the terrorists and they may use it on a vast scale to create terror. Anthrax letters were used after 9/11 in the U.S.A. to create terror. Recently Ricin letters were used in the U.S.A. by the terrorists. Bioterrorism is the use of biological weapons as terror attack or terror threat or use of biological weapons in terrorism. In Bioterrorism agents may be bacteria, viruses or toxins.

The various agents of bioterrorism may be bacteria like Bacillus anthracis (Anthrax), Yersinia pestis (Plague), F. tularensis (Tularemia), Vibrio cholerae (Cholera) and Salmonella typhi (Typhoid fever) or viruses like Ebola and Marburg (Yellow fever), Variola virus (Small Pox) and viruses causing flu, Congo Crimea hemorrhagic fever and encephalitis. These may be Toxins; which may be naturally occurring toxins from plants, bacteria and viruses e.g. Bacterial botulinum (Botulism), C. perfringens, Staphylococcal enterotoxins B, mycotoxins from fungi, and ricin.

A biological agent, which can be produced easily, has a long shelf life, can be easily dispersed and can produce high mortality rate within a short span and does not have an effective treatment will be an ideal agent for biological weapons. It requires considerable sophistication to produce biological weapon. It should be very infectious i.e. 10 to 50 organisms should be able to cause disease. Genetic modifications to make organisms drug resistant increase the effectiveness of biological weapon. It is not easy to find out the source of attack of bioterrorism. It causes a panic in the population, as the attack is invisible, slow and deadly. There is economic disaster when it involves livestock or crops. Biological weapons are cheap and have enormous power of destruction of life. The estimated cost of killing unprotected civilians in an area of one square mile is about \$5,000 for conventional weapons, \$2,000 for nuclear weapons, \$1,500 for nerve gas weapons, and only a meager \$2.50 for biological

Biological weapons have some disadvantages also e.g. the effect is not immediate due to different incubation periods of various agents before the symptoms appear and the disease can develop. If there are strong winds then the disease may spread into the area other than the target area and if weather is very hot germs may be killed by the adverse weather and may not remain effective. A feeling of hatred will develop against the persons using biological weapons

Biological weapons are not in common use because it is difficult to produce and handle such weapons of sufficient lethal strains in bulk. It is difficult to transport such weapons without affecting their efficacy. Small amount of pathogens may destroy a herd of animals, field of crop or city of population but terrorists need to know how to disperse the pathogen effectively, and this involves ensuring that the pathogen is delivered to the target over a large area in the right particle size and in sufficient concentration to cause mass infection. For weaponizing a biological agent a detailed knowledge of the behavior of biological organisms in air is required because it is exposed to sunlight and varying degrees of temperature, which can cause the death of the microorganism. As the biological agents survival is very difficult outside the laboratory a large amount of the agent may be required to cause perceptible damage.

Usually such attacks will be through aerosols by some specially designed aircraft if a large population is targeted or may be as a sporadic event as through letters (anthrax spores). Such aerosol attacks usually produce severe respiratory illnesses some of which may be life threatening. In 1972, Biological Weapon convention was signed by 144 countries to prevent the use of biological weapons but in bioterrorism it is not effective.

Detection of use of biological weapon is a big problem unless it is an announced event by the terrorists but this may not be always and it may be a covert incidence; many a times there may be hoaxes only. In such situations it may become very important to detect and diagnose such an attack. Such detections may be syndrome based or based upon the epidemiological features of the diseases in a given population. In syndrome based criteria we detect the disease on the base of the syndrome caused by the disease and do not wait for the results of the laboratory tests to take preventive actions for the further spread of the disease and all the related personnel are alerted to take preventive steps.

From the epidemiological features we may suspect the disease if it presents as an unusual event of some endemic disease. If people with respiratory or gastrointestinal complaints present along with fever in large number of cases and if within hours or days there is a rapidly increasing disease incidence in the healthy population especially. An endemic disease when rapidly emerges at unusual time also gives indication of such an event and an epidemic curve rising and falling during a short period of time also indicates towards such an event. In such attacks people who live indoors are affected less and many people are affected in a single locality and with high mortality rate. If such an event could occur due to bioterrorism, there should be a strong suspicion of bioterrorism attack if all these factors point to bioterrorism

An attack of bioterrorism can be tackled only if there is awareness in the medical profession about bioterrorism. It can be integrated into emergency management or any other mass disaster management. It will involve a multidisciplinary approach involving health departments of state and central governments, private health care providers, local administration, epidemiologists and media people and there should be effective communication between these groups.

It should be emphasized that many of the diseases caused by such agents are not transmitted from person to person and re-aerosolization of such agents remains a remote possibility. We have to take standard precautions to prevent the spread of the disease like hand washing with plain water or with antimicrobial soaps, wearing gowns and disposable or sterilized gloves, wearing facemasks and having eye protection. In some diseases like small pox and pneumonic plague additional precautions are required like prevention of direct contact with all the body fluids (blood, excretions, secretions and non intact skin and mucus membranes.)

Infectious patients will have to be isolated and if sufficient space is not available to isolate such large number of patients, patients with similar signs and symptoms can be put together and movements of such patients should be limited and only essential movements of the patients should be allowed with precautions to reduce the transmission of the disease

Proper precautions should be taken to clean and sterilize the various instruments and equipments. All the surfaces and objects likely to be contaminated by the patients should be properly cleaned with antimicrobial agents. Single use articles should be discarded after the use along with the contaminated waste as per the local guidelines. Every care should be taken to properly handle the linen of the patient. All precautions should be taken to prevent the occupational injuries to the health care providers.

Only when the patient become noninfectious should be discharged but if it is not possible to keep all the patients in the hospital due to large number of patients, instructions should be given to the relatives regarding hand washing, barrier precautions and waste management. They should be instructed regarding the care of the patients and disinfection of the environment

While doing the postmortem on such cases all standard precautions should be taken to prevent the spread of the disease and relatives should be instructed to take precautions while cremating or burying them.

Decontamination of the patient and environment should be considered if there is gross contamination of the patient. Patient should be helped or instructed to take bath with soap and water and no bleaching agent should be used for this purpose. Eyes should be washed with normal saline or ophthalmic solutions. Removed clothes should be handled minimally and should be put in an impervious bag.

If any health care provider is thought to have been exposed such person should be identified and managed.

If large-scale exposure is suspected or present, non-emergency services should be discontinued and available equipment should be judiciously used depending upon the severity of the condition of the patients. Patients should be properly evaluated and those not serious or contagious should be discharged with proper instructions to them. Source should be identified from where to get the vaccines, immune globulins, antibiotics and antitoxins

Arrangements should also be made to handle large number of cadavers, for their postmortem examination and for their cremation and disposal. Usually there is panic, horror and anger against the state and terrorists if such an outbreak occurs. There is fear of infection and social isolation, which causes demoralization of the public. In case of such an event it should be handled carefully and trained psychiatrists, social workers and volunteer religious and non-governmental organizations, should provide psychological support. At the same time anxiety in the health care providers should also be taken care of and they should be properly educated to protect themselves. This fear can be greatly reduced if they are regularly taking part in the disaster drills held regularly.

There should be proper laboratory facilities to diagnose and confirm from the samples both at local level, district level, state level and national level. Samples should be properly packed to prevent the spread of the disease from the samples. Triple packing is advised and there should be no leakage even if the containers fall from a height of six feet. Visitors should be strictly prohibited to visit the patients in the hospitals.

People should be properly informed through the media about the sign and symptoms of the disease, its mode of spread and the precautions which the public should take and when should they seek medical advice in case of need and from where to get that help. This will help greatly in reducing the anxiety, fear and misunderstanding in the public who usually in such circumstances attribute nonspecific symptoms to an attack of bioterrorism.

We should be able to recognize the agent, which can be used for bioterrorism. We should develop tests to rule out agents or confirm them. This can be done locally or can be done by sending the samples to distant laboratories taking due precautions not to spread the disease. We should develop and apply biosafety precautions and safeguards in institutions

dealing with potentially harmful and dangerous organism, which can be used as an agent of bioterrorism. We have to prepare emergency plans to tackle the bioterrorism attack. In such situations a large number of patients will come suddenly. We should have the plans ready for getting the medicines, disinfectants and vaccines in bulk in such situations and there should be cohesion between various agencies involved in tackling such situations. We should have good working relations with the media to avoid panic and horror.

Anthrax is caused by gram-positive *Bacillus anthracis* by eating the infected uncooked meat of goats, sheep and cattle that in turn get infected by ingesting the spores in the soil. *B. anthracis* is a spore-forming bacillus. There cannot be spread of the disease by inhalation from person to person. There can occur secondary cutaneous infection by direct contact with the ruptured vesicle secretions. In bioterrorism attacks usually it will be through aerosols, which will be inhaled

All of us are aware of the anthrax letters attack in the U.S.A., which occurred in the October 2001 and later. Spores of *B. anthracis* are ideal biological weapon and mortality is as high as 85% once the symptoms of inhalation anthrax appear.

The sudden appearance of large number of patients in a region with acute onset of flu like disease and with mortality of about 80% and half of the deaths occurring in 24 to 48 hours of start of the symptoms is highly likely to be anthrax. Anthrax has many properties of an ideal biological weapon.

Botulism is caused with anaerobic gram-positive bacillus *Clostridium botulinum*. In nature it is most commonly seen as a food borne disease but in bioterrorism it may be both foods borne as well as air borne. This bacillus produces a powerful neurotoxin, which inhibits the release of acetylcholine causing flaccid paralysis. Post exposure botulinum antitoxin should be given after sensitivity testing, as there is high rate of hypersensitivity reactions, which may be as high as more than 90%. Public should be informed that it is not a contagious disease and they should not be scared of. Public should be informed of the sign and symptoms of the disease and when and where to report.

Plague is caused with the bacillus *Yersinia pestis* and rodent is the vector. From infected rats transmission occurs by infected fleas. Incubation period is 2 – 8 days. In nature there may occur bubonic plague if spread is lymphatic or if spread is by blood septicemic plague may occur. In an event of bioterrorism event spread will be through aerosol and then there will be pneumonic plague.

The Variola virus causes small pox and in case of bioterrorism event even a single case should be considered as an emergency. Last case of small pox was reported in Somalia in 1977 and on May 8, 2000 WHO declared global eradication of small pox. Small pox has many good qualities of an ideal biological weapon. In aerosol suspension it is quite stable and infection dosage is quite low. It is highly contagious by droplet inhalation as well as by ingestion and direct contact and there is large susceptible population and mortality rate is quite high.

Ebola and Marburg viruses cause viral hemorrhagic fever. Various viruses responsible for viral hemorrhagic fevers are *Arena viridae*, *Bunya viridae*, *Filo viridae* and *Flavi viruses*. Diagnosis is a clinical one and not a diagnosis of laboratory. There is no treatment for various hemorrhagic fevers except a few exceptions. There is no vaccine available for prevention.

Brucellosis is caused with *Brucella abortus*, *B. melitensis*, and *B. suis* and *B. canis*. *B. suis* was the first bioweapon produced by U.S. In this mortality is < 5%. It is a very stable organism. It can be transmitted by ingestion and direct skin contact. It is highly infective by aerosolization and infective dose is 10 -100 organisms with incubation period of 5 days to more than 6 months. In this there is no person-to-person transmission.

Tularemia is caused by bacterium *Francisella tularensis* that is found in rodents, rabbits and hare. Infection spreads by directly breathing in the bacteria, drinking infected water or eating infected food or handling infected carcasses. It also spreads by being bitten by infected ticks, deerfly or other insects. It is not known to spread from person to person so no isolation is required. Treatment is with antibiotics and vaccine for this is still under review.

Ricin is a toxin produced from the seeds of *Ricinus communis* (castor oil). This toxin is glycoprotein in nature and acts as a cellular poison and inhibits protein synthesis in the cells. It has a wide availability. After extraction of the oil from the seeds of castor oil ricin is present in concentration of 5% in the left over waste. Seeds of castor oil are available easily and ricin poison is quite stable for a long time hence it is good for a biological weapon, as it has no specific treatment also. It was used in the past to assassinate the enemies. Recently three senate buildings were closed after tests confirmed the presence of ricin in the powder found in the office of the senate majority leader in U.S.A. Ricin is poisonous by numerous routes. It can be used in water, food, and aerosol or by injection by laden projectiles. Aerosol can be prepared by liquid ricin or lyophilized powder. All these routes can be used by bioterrorists. Protective masks are useful and they give protection against aerosol exposures. Decontamination by washing with soap and water will be useful. There is no specific treatment. No antitoxin or vaccine is available for its treatment or prevention. Only symptomatic treatment is there. Anti cough and antipyretics will help the patients. Care should be taken for adequate hydration. Respiratory support will be needed.

Prof. R.K.Gorea

PATTERN OF FINGER-PRINTS IN DIFFERENT ABO BLOOD GROUPS

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ABSTRACT:

Finger print (dactylography / dermatoglyphic) is considered as the best tool of identification. This study was carried out in 2000-2001 on 300 students of different ABA blood groups of Medical College, Ajmer with two objectives, viz. (a) To study distribution of finger print pattern among the subjects having different ABO and Rh blood group and (b) Correlate any relation between their characters and blood groups. Male: female ratio was 2.4:1. Majority of the subjects (38.33%) in the study were of blood group A followed by blood group B, A and AB of whom 95.67% were Rh-positive. The general distribution of pattern of finger print showed high frequency (51.87%) of loops whereas whorls were moderate (35.83%) and arches were least (12.30%) in frequency. Almost same order was noticed in both Rh-positive and Rh-negative individuals or A, B, AB and O blood groups. Blood group A showed more loops (Rh +ve 54.26%, Rh -ve 60%) while, blood group AB had more whorls (Rh +ve 43.34%, Rh -ve 60%). The study suggests an association between finger print pattern and blood group. The distribution of different pattern of finger prints in individual fingers also showed some peculiarities in relation to blood group. The total finger ridge count (TFRC) was significantly greater in blood group B.

KEY WORDS: Finger Print, Dermatoglyphic, Dactylography, Identification.

INTRODUCTION:

Cummins [1] coined the term dermatoglyphic (derma=skin + glyphs=curves) to the dermal ridge configurations on the digits, palm and sole. They develop between 13th to 19th weeks of prenatal life, Purkinje [2] for the first time distinguished nine principal configurations of rugae and sulci present on the terminal phalanges of human hands. Faulds [3] mentioned that the pattern of these papillary ridges remain unchanged in an individual throughout life. Herschel [4] used finger prints for personal identification in India. Galton [5] classified the types of finger prints depending upon their primary pattern as loops, whorl and arches. Cummins [1] found that the configurations of ridge pattern are determined partly by heredity and partly by accidental or environmental influence, which produce stress and tension in their growth during foetal life. Forest [6] reported that dermatoglyphic are laid down early in embryogenesis and represent

a part of structural constitution Bloterogel and Bloterogel [7] expressed a correlation between physical characters and blood groups. Hahne [8] in his study asserted that blood group O is associated with more loops and less whorls than blood group A. Herch [9] found high frequency of loops in blood group A. Recently in India Gowda and Rao [10] in their study on Gowda Saraswat Brahmin community of south Kannada district (Karnataka) reported high frequency of loops with moderate whorls and low arches in the individuals of A, B and O blood group. They also found significantly greater number of loops in Rh-Positive and whorls in Rh-negative subjects in their study total finger ridge count (TFRC) were higher in blood group A. The objective of study; carried out in the department of anatomy in JLN Medical College, Ajmer (Rajasthan) was to ascertain trends of finger prints in individuals with different ABO and Rh blood groups along with evaluation of relationship

between the pattern of finger prints and blood groups.

MATERIAL AND METHOD:

This study was carried out in the department of Anatomy at JLN Medical College, Ajmer. 300 medical students were randomly selected for study and their finger prints were studied. For taking dermatoglyphics, Ink Method suggested by Cummins [1] was used. Kores camel duplicating ink was spread with the help of a roller over an inking slab. A 15" x 6" sized plain glass was used as inking slab. The smeared palm and fingers of both hands were printed on a durable plain paper laid down on a pressure pad. Primary patterns (loops, whorl and arches) were observed along with the total ridge counting with the help of a powerful hand lens

OBSERVATIONS:

Sex and Blood Group (Table - 1)

Males out numbered the females in this study, the male: female ratio being 2.4:1. Majority of cases 115 (38.33%) in the study belonged to blood group O; followed by blood group B, A and AB which were 110 (36.67%), 50 (16.67%) and 25 (8.33%) respectively.

Rh Blood Group (Table - 2)

287 (95.67%) cases in the study had Rh-positive factor, of which 108 (36.0%) each belonged to blood group O and B. 47 (15.67%) cases were having A. Blood group with Rh-positive factor and almost half this number 24 (8.0%) belonged to AB positive blood group. Most of the Rh-negative cases 7 (2.33%) were of blood group O

Type of Finger Print (Table - 3)

Loops were the most common pattern,

Table: 1 Distribution of cases according to sex and blood groups

Sex	Blood group				Total
	A	B	AB	O	
Male	35 (11.67%)	75 (25.0%)	18 (6.0%)	84 (28.0%)	212 (70.7%)
Female	15 (5.3%)	35 (11.67%)	7 (2.33%)	31 (10.33%)	88 (29.33%)
Total (n)	50 (16.67%)	110 (36.6%)	25 (8.33%)	115 (38.33%)	300 (100%)

Table: 2 Distribution of cases according to Rh blood groups.

Blood group	Rh - positive	Rh - negative
A	47 (15.67%)	03 (01 %)
B	108 (36.0%)	02 (0.67%)
AB	24 (8.0%)	01 (0.33%)
O	108 (36.0%)	07 (2.33%)
Total (n)	287 (95.67%)	13 (04.33%)

Table: 3 General distributions of primary finger print patterns in all fingers of both hands

Pattern of finger print	Total	Percentage
Loops	1556	51.87
Whorls	1075	35.83
Arches	369	12.30
Total	3000	100

Table: 4 Distribution of pattern of finger prints among subjects of A, B, O and Rh blood groups (n = 3000)

Type of Finger print	Blood gr. A		Blood gr. B		Blood gr. AB		Blood gr. O	
	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve
Whorl	169 (35.96%)	8 (26.67%)	36 (33.33%)	07 (35.0%)	104 (43.34%)	6 (60.0%)	400 (37.04%)	21 (30.0%)
Loops	255 (54.26%)	18 (60.0%)	579 (53.61%)	9 (45.0%)	125 (52.08%)	3 (30.0%)	528 (48.09%)	39 (55.71%)
Arches	46 (9.78%)	4 (13.33%)	141 (13.06%)	4 (20.0%)	11 (4.58%)	1 (10.0%)	152 (14.07%)	10 (14.29%)
Total (n)	470	30	1080	20	240	10	1080	70

Table: 5 Distribution of pattern of finger prints in different fingers of both hands of subjects (n = 300 x 2) (I = loops, W = whorls and A = arches)

Individual Finger	Blood groups											
	A (n = 50x2)			B (n = 110x2)			AB (n = 25x2)			O (n = 115x2)		
	I	W	A	I	W	A	I	W	A	I	W	A
Thumb (t)	53 53%	38 38%	9 9%	133 60.4%	73 33.1%	14 6.3%	22 44%	28 56%	0 0%	133 57.8%	79 34.3%	18 7.8%
Index (i)	41 41%	41 41%	18 18%	79 35.9%	75 34.1%	66 30%	16 32%	26 52%	8 16%	74 32.1%	91 39.5%	65 28.2%
Middle (m)	64 64%	20 20%	16 16%	141 64.1%	41 18.6%	38 17.2%	30 60%	18 36%	2 4%	128 55.6%	61 26.5%	41 17.8%
Ring (r)	35 35%	61 61%	4 4%	73 33.1%	127 57.7%	20 9.1%	20 40%	28 56%	2 4%	65 28.2%	144 62.6%	21 9.1%
Little (l)	80 80%	17 17%	3 3%	162 73.6%	51 23.2%	7 3.2%	40 80%	10 20%	0 0%	167 72.6%	46 28%	17 7.3%

Table: 6 Total finger ridge counts in A, B, O blood groups

Blood group	Total finger ridge count		Total
	Right hand	Left hand	
A	3330	3766	6496
B	6557	6873	13430
AB	1782	1637	3419
O	6011	5803	11814

registering 51.87% frequency in the study; followed by whorls (35.83%) and arches (12.30%).

Pattern of Finger Prints in Different Blood Groups (Table - 4)

Frequency of loops was highest in both the Rh-positive and Rh- negative subjects of ABO blood groups; followed by whorls and arches except,

blood group AB where the incidences of whorls (43.34% in Rh +ve and 60% in Rh-ve) were more. Incidence of loops varied between 30% (in 'AB' negatives) to 60% (in 'A' negatives) among the subject of different blood group of whom, blood group A showed highest loops (Rh +ve 54.26%, and Rh -ve 60%). Whorls showed moderate

frequency followed by arches ranging between 26.67% (in 'A' negatives) to 60% (in 'AB' negatives) and 4.58% (in 'AB' positives) to 20% (in 'B' negatives) respectively.

Pattern of Finger Prints in Different Fingers (Table - 5)

The thumb, middle and little fingers of A, B and O blood group showed high frequency of loops i.e. Blood group A (t-53%, m-64% and l-80%); blood group B (t-79%, m-64.09% and l-73.64%) and blood group O (t-57.82%, m-55.65% and l-72.61 %). Whorls were more in ring fingers (blood group 'A' 61 %, 'B' 57.73% and 'O' 62.61 %). Individuals of AB blood group also presented more whorls in their thumbs (56%), index (52%) and ring (56%) fingers whereas; their middle and little fingers have 60% and 80% loops respectively. Frequency of arches were least (less than -10%) in majority of cases but index and middle fingers of blood group A, B and O individuals showed comparatively high frequency.

Total Finger Ridge Counts (TFRC) In Different Blood Groups (Table - 6)

TFRC was highest in blood group B (13,430) followed blood group O (11,814). In blood group A the TFRC was about half (6496) and in blood group AB it was about one fourth (3419) of the number of counts in blood group B and O. TFRC was almost equal in both hands.

DISCUSSION:

The present study reveals that there is an association between distribution of finger print (dermatoglyphic) pattern and blood groups [6, 7, 8, 9, 10] the general distribution pattern of the primary finger print was of the same order in individuals with A, B, AB and O blood group i.e. High frequency of loops, moderate of whorls and low of arches [8, 9, 10] the same findings were seen in Rh-positive and Rh-negative individuals of ABO blood group. The correlation is more consistent for blood group A and loops [10], arches were more in blood group AB in present study. The distribution pattern in individual fingers had high frequency of loops in thumb and little finger whereas ring fingers had more whorls and index and middle fingers presented higher incidences of arches in subjects of A, B and O blood groups. Individuals of blood group AB had high frequency of whorl in thumb, index and ring

fingers while middle and little fingers showed more number of loops. None of the previous studies had emphasized on the distribution of different finger prints in different fingers of both the hands. Our study revealed high total finger ridge count in blood group B which is contrary to other studies where, blood group A had a significantly greater number of TFRC.

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AGE ESTIMATION IN OLD INDIVIDUALS BY CT SCAN OF SKULL

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ABSTRACT

Determination of age goes on becoming difficult as the age advances particularly after the age of 40 years with conventional methods. To overcome this problem the present study was carried out. In the present study 100 cases with age range of 40 to 70 years were taken. The study was carried out to estimate timings of suture closure with the help of axial sections at different levels of sutures of skull on CT scan. The closures of lambdoid, parieto-mastoid, coronal and squamous sutures were studied and grading was done depending upon closure of sutures. Each suture was found to close at particular age group. Each individual was exposed to CT scan and 3 axial sections (cuts) were taken for each individual. Each suture was found to close at particular age group.

KEY WORDS:

INTRODUCTION

Scientific estimation of age of an individual whether living, dead or human remains is a vexing problem for Medical Jurist in both civil and criminal matters. Age estimation cases are being referred to Forensic expert. Age estimation of living is most important issue to the court and to common citizen as well. Community relies on medico-legal expert for justice. If proper age is not given, it is injustice to the patient and profession.

Following types of age groups for age estimation are considered: -

1. Gestational age,
2. Infancy to puberty,
3. Puberty to adulthood and
4. Adulthood to old age.

As many studies had been done in past to estimate gestational and infancy to puberty with great accuracy. Estimating age is not an easy task because as age advances estimated, ages given by Forensic experts have wide age range. So to decrease this wide age range combined study including general physical examination and closure of sutures of skull will be done in present study. Other factors that are likely to affect age are: racial, nutritional, endocrinal and hereditary determinants.

The study done by Krogman in 1962 is very old and may not be applicable today because due to evolution, the results may vary a lot and also results vary from country to country and also from region to region. The factors to be considered in present study for age estimation in old age from 40-70 years in both male and female individuals are Computed Tomography of Head for lambdoid suture closure, ecto-cranially.

Epiphysis of bones unite and sutures of skull close at a particular age for a given population it is of great medico-legal importance as most reliable evidence of age of a person. Age estimation help in both civil and criminal cases such as consent, juvenile offenders, kidnapping, rape, marriage, attainment of majority, employment, impotence, sterility, competency as a witness, identification, senior citizen concession, retirement benefits, in old pension cases and in question of age fitness or unfitness.

MATERIAL AND METHODS

In this study hundred cases (Male & Female both) between age group of 40 - 70 years with age interval of five years and twenty cases from each age group were studied who were CT scanned for closure of suture of skull ecto-cranially. Status of suture closure was divided into following five stages:

Stage	Closure of Suture	Grade
I	No closure	A
II	Less than half closure	+
III	Half closure	++
IV	More than half closure	+++
V	Complete closure	++++

Age of each individual studied was confirmed from birth certificate, service record, driving license, passport, ration card or voter's card.

Method for CT Scan: Patient was made to lie supine on CT Scan machine called Somatom Hi Q. Four axial sections were taken on CT Scan at different levels on bone window of suture of skull.

OBSERVATIONS & DISCUSSION

Table 1 - Ages For Suture Closure

S. No.	Name of Suture	Age of earliest union (Years)	Age of Fusion in Majority of cases (Age Group)
1.	Lambdoid	40	45 - 50 years
2.	Parieto mastoid	45	55 - 60 years
3.	Squamous	45	60 - 65 years
4.	Coronal	40	45 - 50 years

Table 2 - Comparison of time of closure of lambdoid suture (in years)

Author	Year	Race	Sex			Method	Age of earliest union
			Male	Female	Mixed		
Krogman	1962	U.S.A.	-	-	31	Gross skeletal	-
Parikh	1990	Indian	-	-	45-50	X-ray	-
Vij	2001	Indian	-	-	About 55	X-ray	-
Present	2001-4	Punjab	-	-	45-50	CT Scan	45

Table 3 - Comparison of time of closure of Parieto-mastoid suture (in years)

Author	Year	Race	Sex			Method	Age of earliest union
			Male	Female	Mixed		
Krogman	1962	U.S.A.	-	-	50	Gross skeletal	-
Parikh	1990	Indian	-	-	55	X-ray	-
Present	2001-4	Punjab	-	-	55-60	CT Scan	45

Table 4 - Comparison of time of closure of squamous suture (in years)

Author	Year	Race	Sex			Method	Age of earliest union
			Male	Female	Mixed		
Krogman	1962	U.S.A.	-	-	50	Gross skeletal	-
Parikh	1990	Indian	-	-	60	X-ray	-
Present	2001-4	Punjab	-	-	60-65	CT Scan	45

Table 5 - Comparison of time of closure of Coronal suture (in years)

Author	Year	Race	Closure of suture in majority of cases	Earliest Union (in years)
Krogman	1962	USA	Type 1 & 2 - 24 to 38 Type 3 & 4 - 26 to 41	-
Parikh	1990	Indian	35-40 years	-
Reddy	1992	Indian	Anterior 1/3rd 20-30 yrs, Middle 1/3rd 40-50 yrs. and posterior 1/3rd 30-40 yrs.	-
Nandi	2000	Indian	Start at 24-25 Yrs. and complete at 45-50 yrs.	-
Vij	2001	Indian	Lower Half 40-50 yrs. and Upper Half 50-60 yrs.	-
Ramachandran	2003	Indian	Upper Half 50-60 Yrs. and Lower Half 40-60 Yrs.	-
Present Study	2001-2004	Indian	45-50yrs.	40 Yrs.

Table 6 - No. of cases showing closure of different sutures at different age groups

Age Group (Years)	<u>Lambdoid Suture</u>			<u>Parieto-Mastoid</u>			<u>Squamous Suture</u>			<u>Coronal Suture</u>		
	No. of cases	Compl union	%	No. of cases	Compl union	%	No. of cases	Compl union	%	No. of cases	Compl union	%
45-50	20	16	80	20	7	35	20	5	25	20	17	85
50-55	20	15	75	20	9	45	20	14	70	20	16	80
55-60	20	14	70	20	14	70	20	13	65	20	18	90
60-65	20	15	75	20	17	85	20	16	80	20	18	90
65-70	20	15	75	20	18	90	20	17	85	20	19	95

SUGGESTIONS FOR FUTURE STUDY

1. In present study, persons between the ages of 25-40 years for closure of suture are not taken, so to find good results, sutures like basilar suture and sagittal suture etc. should be included as these sutures close between this periods.
2. In present study, persons above age of 70 years are not studied so suture like palate should be studied which close at that particular age.
3. As in present study difference between each age group is 5 years and so it will be reduced to get better results.
4. To know suture closure further and more accurately more views e.g. coronal section on CT scan should be included for suture closure.
5. To know closure of suture more coronal or axial cuts for each suture should be taken.

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AN ANTHROPOMETRIC INVESTIGATION INTO THE PROBABLE CAUSE OF FORMATION OF 'CARRYING ANGLE': A SEX INDICATOR

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ABSTRACT

In the living the 'Carrying angle' measures around 173 degrees in males and 167 degrees in females. The cause of its formation is a long debated issue. The present study is an attempt to identify by anthropometric means the sexually dimorphic features in the bones of the elbow joint which makes the 'Carrying angle' a sex indicator. The distal end of the humerus and the proximal end of ulna playing major role in the formation of 'Carrying angle' have been examined for sex difference. The two measurements of the humerus (Trochlear angle and Inclination angle of Olecranon fossa) and three measurements of the ulna (Olecranon – coronoid angle, length and width of inferior medial trochlear notch) were devised for the study. Though the humeral angles failed to show any sex difference, the angle and dimensions of ulna exhibited statistically significant result. Could these parameters be the cause of sex differences the 'Carrying angle' exhibits at the elbow joint?

KEY WORDS: 'Carrying angle', sexual dimorphism, humerus, ulna

INTRODUCTION

When the forearm is completely extended and supinated, the long axis beyond the elbow joint is not in line with the upper arm but is deviated laterally. This is referred to as 'Carrying or Cubital angle' [Fig.1]. It measures around 173 degrees in males and 167 degrees in females [1]. The angle is neutralized when the forearm is flexed or pronated from extended supinated position.

The role of 'Carrying angle' in the sex determination and its cause of formation is a long

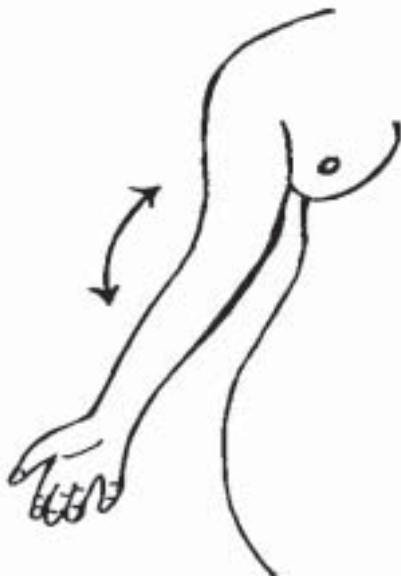


Fig. 1: 'Carrying angle' at the elbow joint

debated issue in two 'A's, Anatomy and Anthropology. Surveying the available literature on the subject indicates that authors have expressed different views about its cause of formation. According to Mall [2], the axis of the elbow joint is set obliquely at nearly 84 degrees to both the humerus and ulna which is also agreed upon by Jones [3] after a lapse of nearly half a century. Langer [4] was of the opinion that the obliquity of the trochlea to the shaft of humerus is the cause. Even Decker [5] after more than a century gave the same reason pointing out that the inner lip of the trochlea of humerus is a ridge [groove] which is much deeper distally than anteriorly so that the ulna [with the forearm] is deflected in full extension by this ridge. Thinking on a similar line Kapandji [6] explained that the angle is formed as a result of the trochlear groove being vertical anteriorly but on the posterior aspect it runs obliquely, distally and laterally. This results in the formation of 'Carrying angle' in extension when the posterior aspect of the oblique groove makes contact with the trochlear notch of ulna and the angle is masked during flexion when the trochlear notch lies on the vertical groove in the anterior aspect.

William et al. [7] considered the medial edge of the trochlea of humerus partly responsible as it projects nearly 6 mm below the lateral edge and the obliquity of the superior articular surface of the coronoid process which is not set at right angles

to the shaft of ulna. Last [8] suggested that in the ulna a curved ridge joins the prominences of the coronoid and olecranon processes which fits the groove in the trochlea of the humerus. The obliquity of the shaft of ulna to this ridge accounts for most of the 'Carrying angle' at the elbow.

Keeping the above views in mind, an attempt has been made in the present study to examine the sexual aspect of the 'Carrying angle' using some of the above suggested causes. Prior to devising measurements to fulfill the above objective it was felt necessary to understand the alignment of bones as it is when the arm is extended and supinated [i.e. when 'carrying angle' is formed]:

1. Distally, the medial lip of the trochlea of humerus rests on the inferior medial trochlear notch of ulna [Fig. 2a]
2. The ridge joining the prominences of olecranon and coronoid processes of ulna fits the groove in trochlea of humerus [Fig. 2a].
3. On the posterior aspect, the olecranon process of ulna fits into the olecranon fossa of the humerus [Fig. 2b].

New anthropometric measurements were devised to study the possible cause of sex difference.

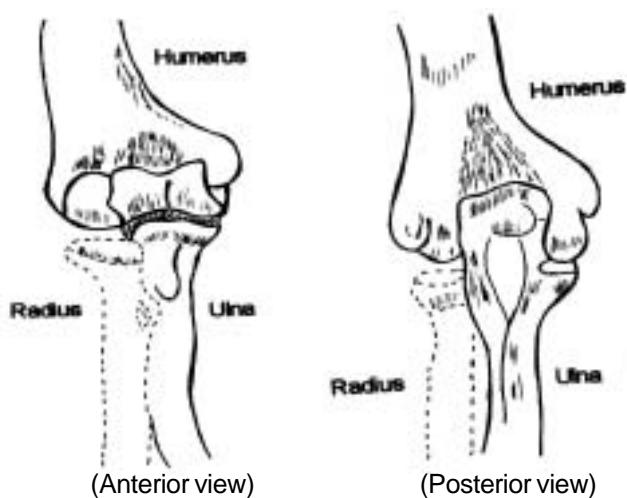


Fig. 2: The alignment of bones when the arm is extended and supinated

MATERIALS AND METHODS

The study was conducted at the Medico-Legal Institute at Bhopal in India. Twenty male and female bones were first exposed to the new methods of measurement to indicate the trend before enlarging the size of the sample. Data for this study are comprised of 40 humeri [20 males

and 20 females] and 160 ulnae [100 male and 60 female]. The bones were dry and belonged to adult residents of central India.

The Medico-Legal institute at Bhopal is one of the premier institutions of India where the Police department and the legal authorities of central India refer all the medico-legal cases of the state for expert opinion. The second author [being the founder and former Director of the Institute] started with the collection and storage of skeletal material in 1973. The Institute has a collection of bones from medico-legal cases and unclaimed specimens. A majority of the sample were medico-legal specimens. Very few of the specimens were remains of unclaimed bodies, which were skeletonised in the department. Information regarding probable age at death, race, sex, and date of arrival in the institute, probable cause of death etc. was well documented in a register after examination. The bones were preserved in iron boxes coded with serial number. Abnormal or pathologically deformed bones were excluded from the study. Every care had been taken by the authors to include bones from a homogenous population.

In order to test for bilateral variation in the measurements, 20 sets of bones were subjected to a paired t-test. The difference was found to be insignificant at the 0.05 level, thus allowing the bones of both sides to be grouped together. However, only one bone, either left or right, has been included in the analysis.

Two measurements for humerus and three for ulna have been devised in this study based on the suggested cause of formation of 'Carrying angle'.

Measurements on Humerus

Trochlear angle: The humerus was placed with its posterior surface in contact with the osteometric board. A thread was adjusted to lie parallel to the distal most points on the lateral and medial projection of trochlea X and Y respectively. Care was taken to avoid the projecting capitulum [Fig. 3]. Another thread was adjusted to lie parallel to the long axis MN of the distal part of the shaft, where M and N were the midpoints of transverse diameters at the distal ends of upper four-sixth AB and upper five-sixth CD of the humeral length respectively. The angle was read between the threads MN and XY.

Inclination angle of olecranon fossa: The humerus was placed on the osteometric board with its anterior surface in contact. A thread was adjusted to lie parallel to the line joining the medial most extent A and lateral most extent B along the border of the olecranon fossa [Fig. 4]. The other thread was so adjusted that it lay parallel to the line joining the proximal most points on the articular border of trochlea, medially as C and laterally as D. The angle was read between the threads lying parallel to AB and CD on the osteometric board.

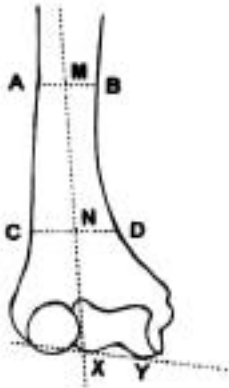


Fig. 3: Trochlear angle of humerus

AB and CD are the transverse diameters at the distal ends of upper four-sixth and five-sixth of the humeral length respectively. MN is the long axis of the distal portion of the humerus shaft whereas XY represents the tangent to the distal most points on the lateral and medial projections of trochlea

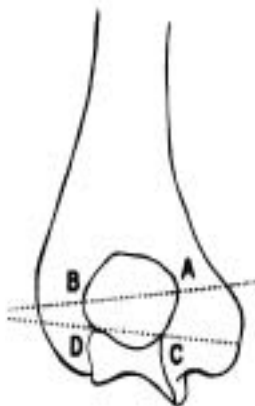


Fig. 4: Inclination angle of Olecranon fossa of humerus

AB, the line across the border of the olecranon fossa and CD along the proximal articular border of trochlea when joined and extended forms the angle

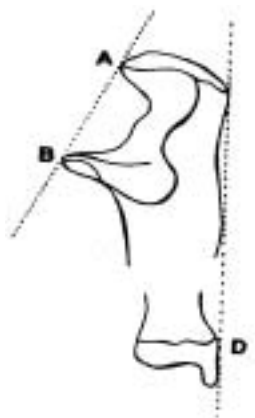


Fig. 5: Olecranon – Coronoid angle of ulna

The line AB joins the apex of projecting 'beak' of processes, Olecranon and Coronoid, marked A and B respectively. The bone is aligned with the Posterior most surface of the styloid process D touching the horizontal side Wall of the board

Measurements on Ulna

Olecranon - Coronoid Angle: The ulna was placed with its medial surface in contact with a board, especially designed for the purpose of measuring this angle [10]. The bone was placed in such a position on the board that the point projecting most posterior on the styloid process D touched the lateral wall of the board. The thread was adjusted to lie parallel to the line joining upper lip of the olecranon process A and the 'beak' of the coronoid process B. The angle was measured between the lateral wall of the board as a base and the thread joining the line AB [Fig. 5], extended to meet the base line. The angle was measured with a protractor.

Length and Width of Inferior Medial Trochlear Notch [IMTN]: The ulna was held facing anteriorly and the deepest constriction along the medial and lateral borders of the trochlear notch were labeled medially as P and laterally as Q [Fig. 6]. The highest point on the 'beak' of the coronoid process was labeled as B and the line along the ridge from the point B extending proximally to meet the line PQ at C dividing the coronoid articular surface into larger medial and smaller lateral part

The length of the inferior medial trochlear notch was measured with the help of Dial caliper between the point C and the highest point B on coronoid 'beak'. The width was measured at right angles to the length, between MN, N being the point projecting most medially on the border of trochlear notch on the 'Sublime Tubercle' and M was the line drawn laterally from point N meeting the line BC at right angles

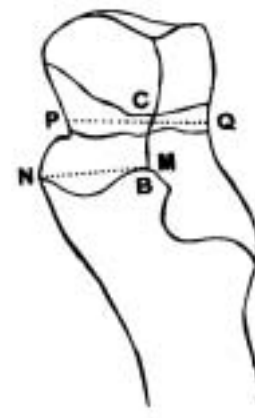


Fig. 6: Length BC and width MN of Inferior medial trochlear notch of ulna.

PQ is the deepest constriction at the junction of Olecranon and Coronoid Processes

The length and width of IMTN was further incorporated into an index using the formula:

Simple statistical analysis including mean, standard deviation and t-test was performed to study the sexual difference. Data on ulna were further subjected to discriminant function analysis using the SPSSX Subroutine software [9]. Except for the percentage of accuracy achieved by the three parameters of ulna the detailed analysis has been reported elsewhere [10].

RESULTS

The study on humerus used two variables, trochlear angle and Inclination angle of olecranon fossa. Table 1 shows the routine statistical analysis of their data. Both the angles exhibit similar mean value for males and females which is further confirmed by the statistically insignificant t-value. Hence the sample size was not enlarged beyond 20 males and 20 females.

Table 1 - Routine statistical analysis for Humerus angles

Angles	Males (20)		Females (20)		T- test
	Mean	SD	Mean	SD	
Trochlear Angle	104.23	2.42	104.53	1.76	P > 0.05
Inclination Angle of Olecranon fossa	4.88	1.60	5.43	2.15	P > 0.05

Table 2 presents the simple statistics for ulnar data. The male ulna exhibit greater value for angle and dimensions than the female. The sex difference measured by using t-test is also highly significant. The width-length IMTN index presents an insignificant sex difference. The direct variables when subjected to discriminant function analysis registered a fairly high accuracy especially for Olecranon – Coronoid angle (85%) in assigning sex.

Table 2 - Statistical analysis for Ulnar measurements

Variables	Males (100)		Females (60)		T- test	Percentage accuracy using DFA a
	Mean	SD	Mean	SD		
Olecranon Coronoid angle	22.26	3.47	14.73	4.46	P < 0.001	85.0%
Length IMTN	16.01	1.40	14.39	0.98	P < 0.001	73.8%
Width IMTN	14.10	1.24	12.47	1.59	P < 0.001	70.6%
IMTN Width-Length Index	0.89	0.09	0.88	1.01	P > 0.05	-

a DFA = Discriminant function analysis

DISCUSSION

An observation by Hooton [11] which became the basis of 'Carrying angle' theory is that the broad shoulders and narrow hips of male allow the arms to hang straight downwards, with long axis of the upper and lower segment approximately in the same straight line. Whereas in the female, the narrower shoulder and broader hips require a splaying out of the forearm axis in order that the hanging arms clear the hips. This may be true when palms are facing forwards as in anatomical position, but this argument will not stand in walking when the mid prone position is obtained with thumb directed forwards.

The present study had been undertaken with the sole purpose to identify by anthropometric means the sexually dimorphic features in the bones of the elbow joint which makes the 'Carrying angle' a sex indicator. For this the main players in the formation of 'Carrying angle', the distal end of humerus and the proximal end of ulna had been critically examined for sex difference.

Following the suggestion of Langer [4], Decker et al. [5] and William et al. [7] that the obliquity of the trochlea to the shaft of humerus and the projection of the medial flange of trochlea of humerus below the lateral edge is partly responsible for the 'Carrying angle' the present exercise of measuring the trochlear angle was undertaken expecting that the shaft obliquity and trochlear projection will be more in females. But as far as the sexual difference in the angle is concerned it has given an inconclusive result.

Steel and Tomlinson [12] have measured the trochlear angle of English humerus and obtained statistically insignificant sex difference [73.3 degrees for males and 74.5 degrees for females]. The lower value of the angle indicates that they have measured the inner angle instead of the outer on the medial side of humerus. According to Martin and Saller [13] the angle is always positive (probably

meaning thereby more than 90 degrees) implying that the tangent of the trochlea is inclined outward and upward. The method adopted in the present study for measuring the angle is different from them. But whatever is the method adopted their result also shows that trochlear angle cannot be used as a sex indicator.

In full extension on the posterior aspect the olecranon process of ulna fits in its corresponding fossa guided by the articular surface of trochlea of humerus. To check whether the inclination of the olecranon fossa with respect to the proximal trochlear articular border is same in both sexes, the measurement inclination angle of olecranon fossa had been devised. Instead of taking the long axis of the humerus as the base line, in this study line CD being the guiding hinge had been taken while line AB joining the medial and lateral most points on the border of the olecranon fossa represents the maximum width. Again the result was not productive for conclusion.

Shifting our attention to the adjacent bone and working on the suggestion given by Last [8] that the obliquity of the shaft of ulna to the line joining the prominences of olecranon and coronoid processes may be the cause of formation of 'Carrying angle', the measurement Olecranon – Coronoid angle was devised. The posterior surface of the ulna was put against a flat surface of the board devised with styloid process touching the board. This is virtually the position which is obtained in the fully extended supinated forearm.

As suggested by William et al. [7] and Last [8] it is a fact that upper end of ulna is at an angle with the long axis of the shaft and this comes to play its part only when the arm is extended and the olecranon process fits in the fossa. The sex difference exhibited by the angle has been proved by the highly significant t-value and also the high percentage accuracy achieved when subjected to discriminant function analysis.

In full extension, distally the medial lip of the trochlea of humerus rests on the IMTN of ulna [Fig. 2a]. On the presumption that if the relative size of female ulnar IMTN is smaller than male then in full extension the IMTN of ulna unable to contain the full projection of trochlea in its small area, will be pushed more laterally thereby reducing the 'Carrying angle'. Referring to Table 2, one finds that the mean length of IMTN among males [16.01mm]

is significantly larger than that of females [14.1mm]. Similar is the trend for width of IMTN indicating a smaller articular surface available in females. But when the relative size of IMTN [Width – length Index] is compared between sexes, the result was inconclusive. Thus it indicated that though there is a difference in size in male and female IMTN, the difference is proportionate to the size of the bone.

In the present study the lower end of humerus does not show any sexual difference with relation to the measurements taken. But the adjacent bone ulna when studied for Olecranon-Coronoid angle showed clear cut sexual difference. We have no study to compare our result but the angulation and configuration we find at the upper end indicates that the forearm may show results of sexual dimorphism in the movement at the elbow joint particularly in the fully extended forearm.

CONCLUSIONS

1. Olecranon - Coronoid angle exhibiting high sexual dimorphism may be one of the cause of sexual difference observed in 'Carrying angle'.
2. The smaller Olecranon - Coronoid angle of female ulna suggests that the projection of olecranon process in female may be relatively larger than in male.
3. More investigations are required on this topic to resolve the issue of 'Carrying angle' being a sex dominant character.

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PATTERN AND DISTRIBUTION OF INJURIES IN FATAL ROAD TRAFFIC ACCIDENTS IN ROHTAK (HARYANA)

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ABSTRACT

Accidents are now one of the major causes of death. In this study pathological features of these cases as type of injury, pattern and distribution of injuries, body parts involved, fatal injuries and cause of deaths were noted at the actual autopsy examination of victim. All the data thus collected was analyzed statistically.

KEYWORDS: Stab wound, homicidal, suicidal, critical analysis.

INTRODUCTION

The term accident has been defined as an occurrence in the sequence of events which usually produces unintended injury death or property damage [1]. Among all types of accidents, those caused by motor vehicles claim the largest toll of life and tend to be most serious. There are almost 885,000 deaths from road accidents annually and total casualties number goes up to 10 million. 80,000 people were killed in 1998 in road accidents in India as compared to 60,000 in 1991, 40,000 in 1986. Studies done by WHO show that road accidents account for 2.5% of total deaths. But in age group of 5-44 years, it is as high as 10% and is among six leading causes of death [1]. According to study conducted by National Transportation Planning and Research Centre, Delhi a person is killed or injured in every 4 minutes in traffic accidents in India.

Accidents constitute a complex phenomenon of multiple causation. The etiological factors are classified into human and environmental factors [2]. There is a steep rise in vehicular accidents in present era due to urbanization and tremendous growth in road transport sector. Population explosion is a catalyzing factor for a number of accidents. The important human factors could be lack of adequate traffic planning and consumption of alcohol.

The present study has been carried out regarding the various epidemiological, medicolegal aspects of vehicular accidents in our country making an attempt to establish various causative

factors, pattern and distribution of injuries and thereby to plan successful measures against it.

MATERIAL AND METHODS

450 cases of fatal road traffic accidents brought to mortuary of Department of Forensic Medicine, PGIMS, Rohtak during one year period 20.05.2000 to 19.05.2001 comprised the material for the present study. Various demographic and epidemiological characters related to victim's accidents were gathered from police records or by direct interrogations of the police officials, or relatives and friends of deceased accompanying dead bodies. The pathological features of these cases as type of injury, pattern and distribution of injuries, body parts involved, fatal injuries and cause of deaths were noted at the actual autopsy examination of victim. All the data thus collected was analyzed statistically.

RESULTS

450 fatal road accidents which occurred during one year period, constituted 29.8% of total medicolegal deaths autopsied (1510) during same period.

1. Types of Road user killed in road accidents
Pedestrians were the commonest group of victims involved, comprising 28.7% cases, followed by occupants of cabs and jeeps (25.8%) and motor cyclists (23%).

2. Age and Sex group involved in road accidents
The commonest age group involved was 21-30 years (27.3%) followed by 31-40 years (20.6%) and

11-20 years (17.3%) males out-numbered females in ratio 9: 1. Two third of cases were in age group of 11-- 40 years.

Table 1: Age and sex distribution of cases (n=450)

Age gp (years)	Males		Females		Total	
	Cases	%	Cases	%	Cases	%
0-10	27	6.7	8	16.7	35	7.8
11-20	76	18.9	2	4.2	78	17.3
21-30	110	27.4	13	27.1	123	27.3
31-40	91	22.6	2	4.2	93	20.6
41-50	46	11.4	8	16.7	54	12.0
51-60	28	6.9	9	18.7	37	8.3
61-70	20	5.0	5	10.4	25	5.6
71-80	3	0.8	1	2.0	4	0.9
81-90	1	0.3	0	0	1	0.2
91-100	0	0	0	0	0	0
Total	402	100	48	100	450	100

Table 2: Distribution of cases according to place of accident (n=450)

Place of accident	Cases	%
National highway	142	31.6
State Highway	122	27.1
City roads	77	17.1
Village roads	78	17.3
Approach roads	31	6.9
Total	450	100

3. Place of accidents

31.6% cases occurred on National Highways and 27.1% cases occurred on State Highways.

4. Seasons and time of occurrence of accidents
Maximum cases occurred in winter 46.23% and between 8-10 A.M. (14.9%) followed closely by 6-8 P.M. (24.7%) and 12-2 P.M. (13.1 %) respectively.

5. Vehicles responsible for accidents

Heavy vehicles were commonest offenders, responsible for 38.9% fatalities followed by cars and jeeps (30.4%) cases.

6. Road accidents, causes and factors

The factor of human error is most significant (74.4%) in which drivers were at fault in majority of cases (55.6%) as against fault of other on road comprising just 18.8% cases. Out of 104 motor cyclists only one was wearing helmet. None of the occupants of cars used protective seat belts.

7. Site of injury

Multiple body parts were involved in each case. Counted together extremity injuries outnumbered others (78.5%). Next were head and face 77.6%, chest 44%, abdomen 31.8% and neck 12.9% of all cases. Total injuries seen in 450 victims were 1,603, injury per case 3.5 whereas total of 1,107 major injuries were seen, injuries per case being 2.4.

8. Type of injury

Fractures, dislocation and lacerations were commonest seen in 89.1 % and 88.8% cases followed by abrasions (84.4%).

9. Fatal injuries

In 450 subjects, 664 injuries or group of injuries were believed to be fatal or contributing to death. Fatal injury per case being 1.4. Head injury was dominant in all road users (50.4%) followed by multiple injuries (15.8%) and thoraco-abdominal injuries (7.6%).

10. Time required to reach hospital (Table 3)

4.2% cases reached hospital within first 15 minutes, 15.4% died on the spot and were not brought to hospital 24% reached within half an hour and 57% reached in next one hour and remaining 19% were rushed to hospital in more than one and half hours. No one received any treatment or first aid at the site of accident.

11. Survival period

Table 4 shows cumulative percentage of dead by various times after accident. Altogether, 39.5% victims had succumbed within 1 hour, 2/3rd (67.8%) by 12 hours, 3/4th (77.1%) by 48 hours and 90% by one week and 97.7% within two weeks. The longest survival period was 30 days and 15 hours.

12. Major regional injuries in different road users

Head injuries were seen in 77.6% of cases. Fracture of Skull and face seen in 51.6% cases which were commonest in motorcyclists and pedestrians, Subdural haematoma was most frequent intracranial haematoma seen in 44.7% cases followed by subarachnoid haemorrhage in 34.7% cases, contusions and laceration of brain were seen in 24.2% cases and herniation of brain was seen in 12.2% of cases. Cervical spine injury was seen in 12.9% cases.

Table 3: Time required to reach hospital (n=450)

Time reqd to hospital	Pedestrian	Scoterist	Cyclist	Occupant of car/jeep	Occupant of MTV	Occupant of HTV	Others	Unknown	Total
<15 min	9 (7)	7 (6.7)	3 (9.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	19 (4.2)
15-30 min	22 (17)	20 (19.2)	6 (18.8)	15 (12.9)	4 (21.1)	3 (15)	3 (17.6)	0 (0)	73 (16.2)
30-45 min	27 (20.9)	23 (22.1)	9 (28.2)	22 (18.9)	2 (10.5)	1 (5)	1 (5.9)	2 (15.4)	87 (19.3)
45-60 min	16 (12.4)	13 (12.5)	1 (3.1)	13 (11.2)	2 (10.5)	2 (10)	4 (23.5)	1 (7.7)	52 (11.6)
1-1½ hrs	20 (15.5)	17 (16.4)	5 (15.6)	22 (18.9)	1 (5.3)	6 (30)	4 (23.5)	3 (23.0)	78 (17.3)
1½-2 hrs	9 (7)	3 (2.9)	0 (0)	11 (9.5)	4 (21.0)	0 (0)	1 (5.9)	1 (7.7)	29 (6.4)
2-2½hrs	8 (6.2)	2 (1.9)	1 (3.1)	5 (4.3)	2 (10.5)	1 (5)	1 (5.9)	1 (7.7)	21 (4.7)
2½-3 hrs	1 (0.8)	3 (2.9)	1 (3.1)	3 (2.7)	0 (0)	0 (0)	1 (5.9)	0 (0)	9 (2)
>3 hrs	3 (2.3)	3 (2.9)	1 (3.1)	3 (2.7)	0 (0)	0 (0)	1 (5.9)	2 (15.4)	13 (2.9)
Spot deaths	14 (10.9)	13 (12.5)	5 (15.6)	22 (18.9)	4 (21.0)	7 (35)	1 (5.9)	3 (23.1)	69 (15.4)
Total	129	104	32	116	19	20	17	13	450

Table 4: Deaths at different time after road accidents (survival period) (n=450)

Survival period	Pedestrian	Scoterist	Cyclist	Occupant of car/jeep	Occupant of MTV	Occupant of HTV	Others	Unknown	Total
0-½ hr	40 (31.1)	34 (32.7)	15 (46.9)	53 (45.7)	11 (57.8)	9 (45)	8 (47.1)	3 (23.1)	173 (38.4)
½-1hrs	1 (0.8)	1 (0.9)	0 (0)	1 (0.9)	0 (0)	1 (5)	1 (5.9)	0 (0)	5 (1.1)
1-6 hrs	29 (22.5)	15 (14.4)	9 (28.1)	24 (20.7)	4 (21.0)	5 (25)	4 (23.5)	3 (23.1)	93 (20.7)
6-12 hrs	11 (8.5)	9 (8.7)	1 (3.1)	9 (7.8)	0 (0)	2 (10)	1 (5.9)	1 (7.7)	34 (7.6)
12-24 hrs	7 (5.4)	5 (4.8)	0 (0)	1 (0.9)	1 (5.3)	0 (0)	0 (0)	1 (7.7)	15 (3.3)
24-48 hrs	6 (4.7)	11 (10.6)	2 (6.3)	6 (5.2)	1 (5.3)	0 (0)	1 (5.9)	0 (0)	27 (6.0)
48-72 hrs	4 (3.1)	7 (6.7)	1 (3.1)	3 (2.5)	0 (0)	0 (0)	0 (0)	0 (0)	15 (3.3)
3-5 days	11 (8.5)	10 (9.6)	2 (6.3)	7 (6.0)	1 (5.3)	1 (5)	0 (0)	1 (7.7)	33 (7.3)
5-7 days	4 (3.1)	3 (2.9)	0 (0)	4 (3.4)	0 (0)	0 (0)	1 (5.9)	1 (7.7)	13 (2.9)
7-14 days	11 (8.5)	9 (8.7)	1 (3.1)	7 (6.0)	1 (5.3)	1 (5)	0 (0)	2 (15.3)	32 (7.1)
>14 days	5 (3.8)	0 (0)	1 (3.1)	1 (0.9)	0 (0)	1 (5)	1 (5.9)	1 (7.7)	10 (2.2)
Total	129	104	32	116	19	20	17	13	450

Figures in brackets shows percentage of cases in each group of road user.

Chest injuries were present in 44% cases and included fracture of ribs 36.9% cases, rupture of diaphragm 2% cases only and contusions and laceration of lungs in 29.8% cases.

Abdominal injuries were seen in 31.8% cases and included laceration of liver (26.9%), spleen 12.7%, gut 4.7%, kidneys 3.8%, bladder 2.9%, fracture of upper limbs 25.6% cases and both bone forearm 26% cases. Fracture of lower limbs was seen in 42.2% cases.

13. Cause of death

Shock and haemorrhage was most common cause of death (36.9%) followed by intracranial hemorrhages (19.6%) and severe brain injury (14.0%).

DISCUSSION

Motor vehicle accidents rank first among all total accidents throughout the world. In year 2000-2001, a total of 1,510 cases were brought for P.M.

examination to this department, out of which 450 cases were due to road accident deaths constituting 29.8% cases. This finding is in accordance with Srivastav and Gupta [8]. The most common age group involved is 21-30 years and males outnumbered females in ratio of 9:1. Two third of cases are in age group of 11-40 years. These findings are similar to studies conducted by McCarrol et al [4], PK Ghosh [10] and Tirpude et al [3].

National and State Highways account for majority of accidents as seen by Srivastav and Gupta [8] Majority of cases occurred in winter due to foggy weather, at times when movement on roads is more i.e. 8-10 A.M., 12-2 P.M., 4-6 P.M. as people went out for schools, offices and other activities at these times. Similar trends were seen by Norman [2].

Pedestrians are commonest group of victims involved comprising 28.7% followed by occupants of car and jeeps (26.8%). Similar trends

were seen by Sevitt [5], Chandra et al [6], Galloway and Patel [7], Srivastav [8], Maheshwari [9], Tirpude et al [3].

Measures against road accidents

As illustrated above there are many causative factors involved in road accidents which include interactions by road users, vehicle and road environment. So a multidimensional approach is the need of the hour.

Road: This includes maintaining existing roads, improving road surface, removing obstacles, constructing guards, rails, proper signs and widening or narrow sections of roads. There should be good road lighting and segregation of slow moving vehicles, pedestrians from highways and use of Zebra crossing, sub ways for pedestrians.

Vehicles: Vehicles design to improve visibility and protection in event of crash, restraining devices as seat belts compulsorily present and proper maintenance of vehicle and regular inspection of vehicles.

Road Users: should be properly trained by authorised centers, medically fit and mentally alert, issuing licenses after strict testing of driving skills, medical fitness "and periodic review of driving skills specially annual medical examination of drivers above 50 years of age.

Administrative Measures: Enforcing traffic rules strictly, proper legislation to avoid drunken driving and in repetitive offenders' license should be cancelled. Establishment of statutory body for prevention of road traffic accidents is necessary.

Emergency medical care: There should be traffic aid posts at suitable distances on the highways to assist injured in case of accidents and quick transport of injured. Policeman at such posts should be trained in first aid procedures and ambulance with para-medical staff, oxygen, and life saving drugs at strategic points must be ready. Hospitals along major highways should be equipped with experienced surgical team, trauma centers with integrated facility of surgical, orthopedics and neuro-surgical, anesthetic experts with modern investigative procedures as C.T. Scan and Blood Banks is best solution for treatment. Modern rehabilitation measures for injured victims form an essential part of casualty service.

The single most important thing a person can do to stay healthy and alive is to pay close

attention to the way he or she drives or walks. Traffic safety education should be given in schools for production of skilled and responsible drivers in future. Members of public should take part in planning traffic Circulation and in designing living areas for benefit of residents. Schools should be located away from traffic. Attempts should be made to reduce travel and if travel is necessary public transport system should be available.

There is no Panacea that will prevent road traffic accidents, what is required is an organized team work by people in many disciplines like education, engineering, medical, law enforcement agencies for effective prevention of road accidents.

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CRITICAL APPRAISAL OF DYING DECLARATION

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ABSTRACT

Dying declaration is very important documentary evidence. It is hearsay evidence but even then it is given a lot of weightage in the court proceedings. Recording of dying declaration is very important. If it is recorded properly by the proper person keeping in mind the essential ingredients of the dying declaration it retains its full value. Missing any single ingredients of dying declaration makes it suspicious and offenders are likely to get the benefits of its shortcomings.

KEYWORDS: Dying Declaration, Compos Mentis

INTRODUCTION

Dying declaration is based on the maxim "*Nemo moriturus praesumitur mentire*" i.e. a man will not meet his maker with a lie in his mouth. Hearsay evidences are not given any weightage in the courts because the person who is giving this evidence is not telling his experiences but that of another person and who cannot be cross examined to verify the facts. Dying declaration is an exception to this rule because if this evidence is not considered very purpose of the justice will be forfeited in certain situations when there may not be any other witness to the crime except the person who has since died. Sometimes it the best evidence in such situations. Its admissibility is explained in the section 32 (1) of Indian Evidence Act. According to this section when the statement is made by a person as to the cause of his death, or any of the circumstances of the transaction which resulted in his death, in cases in which the cause of that person's death comes into question. Such statements are relevant whether the person who made this was expecting death or not [1]. In English law he must be under expectation of death only then this declaration is valid. This declaration is valid both in civil and criminal cases whenever the cause of death comes into question.

If we read the various judgments on the admissibility of dying declaration at times various judges have taken diagonally opposite views and different explanations have been offered though the motive in all have been to provide justice to the people. Main thing is that if these declarations seem trustworthy to courts these retain their full values.

Most important point of consideration is that victim was in a fit condition of mind to give the

statement when recording was started and remained in fit condition of mind till the recording of the statement finished. Merely stating that patient was fit will not serve the purpose. This can be best certified by the doctor who knows best about the condition of the patient. But even in conditions where it was not possible to take fitness from the doctor, dying declarations have retained their full sanctity if there are other witnesses to testify that victim was in such a condition of the mind which did not prevent him from making statement. Medical opinion cannot wipe out the direct testimony of the eyewitness stating that the deceased was in fit and conscious state to make the dying declaration. [2]

Second most important point to be considered is that it should not be under the influence of any body or prepared by prompting, tutoring or imagination. Even if any one of these points is proved then dying declaration is not considered valid. If it becomes suspicious then it will need corroboration.

If a person has made more than one dying declarations and if these are not at variance with each other in essence they retain their full value. If these declarations are contradictory than these lose value.

Best form of dying declaration is in the form of questions and answers. If it is in the form of narrations it is still good because nothing is being prompted and every thing is coming as such from the mind of the person making it. If a person is not capable of speaking or writing he can make a gesture in the form of yes or no by nodding and even such type of declaration is valid. Whenever this is being recorded in the form of questions and answers precaution should be taken that exactly

what questions are asked and what answers are given by the patient those should be written. It is preferred that it should be written in the vernacular which the patient understands and speaks.

It is best that it is recorded by the magistrate but if there is no time to call the magistrate due to the deteriorating condition of the victim it can be recorded by anybody e.g. public servant like doctor or any other person. Courts discourage the recording of dying declaration by the police officers but if there is no body else to record it dying declarations written by the police officers are also considered by the courts. If these are not recorded by the magistrate it is better that signatures of the witnesses are taken who are present at the time of recording it.

In burn cases usually it is debated the person is not capable of making dying declaration due to the effect of burns or due to the narcotic sedation given to treat burns. But Gupta and Jani have opined that neither effect due to burns nor the drugs used to treat burns victims conventionally affects the higher functions. Therefore they safely concluded that *compos mentis* is not affected either by burns or by its treatment [3].

If the person making it is imbecile or is of tender age and was incompetent to testify due to this reason, that dying declaration would not be valid [4]

As a measure of safety original dying declaration should be sent to the court like FIR and its Photostat should be kept in the case file [5].

It does not matter that the person has put a thumb impression or signed it if this is duly witnessed. But in the court question does arise if a person who can sign puts a thumb impression. If a literate person putting the thumb impression is in such a condition that he cannot sign e.g. he was lying in the bed and could not get up to sign it or it was inconvenient for him to put thumb impression due to his condition (intravenous drip on the back of hand) or injury e.g. injury on the right hand in a right handed person. In the absence of such conditions if there is thumb impression and this is not witnessed by disinterested persons a doubt may be created whether this was done after the person died to take revenge by some interested person.

There is usually no time limit that dying declaration becomes invalid if the person died after many months after making the declaration. Cases

are on record when it was considered valid after 4 months.

Even the HISTORY given by the injured recorded by the doctor in the case file has been considered as dying declaration by the honorable Court if it is mentioned that the patient told in the history that incident occurred in such and such manner which was responsible for the death of the victim [6]. Hence it is important that if such history is written as narrated by the victim it should be recorded carefully, keeping in mind the mentioned finding of the court.

First information report got recorded by the police has been taken as dying declaration by the honorable Supreme Court, when the person did not survive to get his dying declaration recorded [7]. But when patient remained admitted in hospital for sufficient days i.e. for 8 days FIR cannot be treated as dying declaration [8].

A suicidal note written found in the clothes of the deceased it is in the nature of dying declaration and is admissible in evidence under section 32 of Indian Evidence Act [9].

CONCLUSIONS

Keeping in view the above mentioned opinions of various courts it is suggested that whenever dying declaration is to be recorded it should be recorded very carefully keeping in mind the sanctity which the courts attach to this piece of evidence. It retains its full value if it can justify that victim could identify the assailant, version narrated by victim is intrinsically sound and accords with probabilities and any material evidence is not proved wrong by any other reliable evidence. [10]. it is perfectly permissible to reject a part of dying declaration if it is found to be untrue and if it can be separated [11]. Conviction can be based on it without corroboration if it is true and voluntary. Dying declaration becomes unreliable if it is not as per prosecution version [12]. This has been summed up the Supreme Court:

1. It is for the court to see that dying declaration inspires full confidence as the maker of the dying declaration is not available for cross examination
2. Court should satisfy that there was no possibility of tutoring or prompting.
3. Certificate of the doctor should mention that victim was in a fit state of mind. Magistrate recording his own satisfaction about the fit

mental condition of the declarant was not acceptable especially if the doctor was available.

4. Dying declaration should be recorded by the executive magistrate and police officer to record the dying declaration only if condition of the deceased was so precarious that no other alternative was left.
5. Dying declaration may be in the form of questions and answers and answers being written in the words of the person making the declaration. But court cannot be too technical.

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RECENT ADVANCES IN LIE DETECTION

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ABSTRACT

Lie detection techniques are utilized by investigating agencies in a wide variety of fields, such as Defence, Secret Services, Terrorism, as the veracity of statements cannot be taken at face value.

KEY WORDS : Lie detection, Polygraph test, f-MRI

INTRODUCTION

Human beings are the only creation of the nature, bestowed with the ability to think, analyze and act accordingly, but few unscrupulous creatures have utilized these capabilities for the wrong purposes. Therefore the society is always on the lookout to develop measures to curb these criminal activities.

There are always new frontiers and novel techniques to combat crime. Recent advances in DNA research [1, 2], Dactylography [3], Cheiloscopy [4] help the investigators to the great extent to crack the case, but their availability is the major limitation.

Lie detection techniques are utilized by investigating agencies in a wide variety of fields, such as Defence, Secret Services, Terrorism, as the veracity of statements cannot be taken at face value.

In the recent times, "polygraph" test has earned a lot of popularity. Typically, under stressful conditions, subconscious psychological events begin to occur which cause the body to respond in a physical sense, like increased sweating, respiration and heart rate, but again these can easily be circumvented.

Recently there has been a technological breakthrough, providing a few new techniques by which it can be proved whether a person is telling the truth or not: f-MRI and Brain Fingerprinting are the much talked about techniques which have revolutionized Forensic investigations.

WHAT IS f-MRI

MRI uses radio waves and a strong magnetic field to provide detailed pictures of internal

organs and tissues. Functional Magnetic Resonance Imaging (f-MRI) is a relatively new use of existing MRI technology; where MRI detects regions where blood vessels are expanding, chemical /metabolic changes are taking place, or extra oxygen is being delivered in an active part of the brain.

In f-MRI, the patient lies on a sliding table, with his head in a brace and is asked to perform a particular task while the imaging is taking place. The metabolism in that particular region of the brain responsible for that task will increase, resulting in changed signal in the MR image. By mapping the signals onto digital images of the brain, f-MRI is able to monitor the movement of blood, determining which areas of the brain are activated by a particular task. [5]

Blood oxygen level dependent (BOLD) f-MRI, measures brain activity associated with deception. Activated areas of the human brain show localized increase in blood flow. Thus, the oxygen content of venous blood increases during brain activation, resulting in increased MR signal intensity. [6, 7]

A classical feature of the human brain is the anatomical specialization of cortical regions for the processing of different types of information. Exploiting this fact Daniel Langleben used f-MRI on 18 volunteers who were subjected to the 'Guilty Knowledge Test'. He found sections of the brain that exercise a significant role in attention, and which monitor and control errors (the anterior cingulate gyrus and parts of the prefrontal and premotor cortex), were more active in the volunteers when they were lying than when they were telling the truth. Langleben said, "If truth was

the brain's normal 'default' response, then lying would require increased brain activity in the regions involved in inhibition and control." [8]

WHAT IS BRAIN FINGERPRINTING

"Brain Fingerprinting", the brain child of Dr Lawrence A. Farwell is a new computer based technology to identify perpetrator of a crime by measuring brain wave responses to crime related words or pictures.[9]

Brain Fingerprinting is based on the principle that the brain is central to all human acts. In a criminal act, there may not be many physical evidences at the crime scene, but the 'brain' is always there recording the sequences of the crime. The Basic difference between a criminal and innocent person is that the criminal has the details of the crime stored in his brain, whereas the innocent does not.

In recent years, EEG has undergone technological advances that have increased its ability to read brain activity from the entire head simultaneously.

In Brain fingerprinting testing, the subject is made to sit in a quiet room with sensors on his headband that measure electrical brain responses. Three types of stimuli: "targets," "irrelevant," and "probes", in the form of words, pictures, or sounds are presented for a fraction of a second each, under computer control. Incoming stimulus that is significant and noteworthy results in a specific , electrical brain response, known as P-300, which is one aspect of a larger brain wave response , known as MERMER (memory and encoding related multifaceted electroencephalographic response).[10]

Until recently, ERPs (event related potentials) method was adopted for the study of information processing brain activity which is a specific, positive and negative voltage changes during the information processing. The only disadvantage of ERPs is their "signal averaging" technique, which eliminates all the complex patterns resulting in the loss of meaningful signals as well [11]

This limitation led to the development of MERA (multifaceted electroencephalographic response analysis). Incorporating this technique Farwell and colleagues found that, MERMER is

elicited, when an individual recognizes an incoming stimulus. [12]

DISCUSSION

F-MRI is still in a phase of infancy and further research should be expanded to incorporate individuals from different demographic profiles in order to establish a broad base for comparisons and to corroborate the pattern predictive of truth telling and deception. Apart from that, f-MRI machines are bulky, expensive and highly sensitive to motion, decreasing the likelihood of its real-world application. Nevertheless, in the near future, with advances in Neuro-technology occurring at such a rapid pace, the admissibility of f-MRI results into courtroom may not be far away.

Looking from the practical point of view, determination of innocence or guilt, however, is a legal entity, rather a scientific determination. The investigating agencies can take the results of 'Brain Fingerprinting' as an evidence, along with all other available evidence, to reach a verdict of guilty or not guilty.

Brain Fingerprinting lie detection technique won a legal victory in the high profile case of Terry Harington, who was convicted of a night watchman's murder in Iowa (USA). He got acquitted as his "Brain Fingerprinting" patterns did not match with the crime scene evidences. Similarly in another case identity of the accused that had raped and killed the victim 15 years back was established through Brain Fingerprinting. [13]

With the Brain Fingerprinting and f-MRI , a new era in security and investigations has began, numerous cases like Miss Jammu Anara's case, Kanchi Mutt Shankracharya's case, DPS MMS case, would be ideal for these 'Lie Detection' techniques. Only time will tell whether suspects in such cases would be able to elude the investigating agencies armed with these technological advances.

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MULTIPLE WOUNDS BY A SINGLE BULLET: A CASE REPORT

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ABSTRACT

A 19 year old boy with multiple entry and exit wounds was brought to the hospital where he succumbed to his injuries. According to the relatives he suffered a gun shot injury due to careless handling of firearm by his father. On autopsy it was found that a single bullet resulted in multiple wounds. The objective of this paper is to highlight the importance of careful examination of firearm wounds and to keep in mind the possibility of correlation between distantly present wounds.

KEYWORDS: Single bullet, Multiple Wounds, Accidental Shooting.

INTRODUCTION

A case of death of a young boy who died due to accidental shooting is reported. The unique feature of this case is that a single bullet resulted in multiple (five) wounds. Although such cases have been reported in literature, the incidence is low. The present case highlights the importance of careful examination of firearm wounds and to keep in mind the possibility of correlation between the distantly present firearm wounds.

CASE REPORT

The deceased was a 19 year old boy. At the time of incident he was lying on the bed. His father was standing outside the room and cleaning the revolver, when accidentally a shot got fired and hit him. The boy was immediately rushed to the hospital, where he could not be revived and died after 6 hours of the incident. Medico legal autopsy was conducted 15 hours after the death.

AUTOPSY FINDINGS

Autopsy examination revealed a well-built body of a young boy. Five wounds were present on the body. Two each on the right knee (Photograph1) and right hand and one on the abdomen with omentum protruding out of the wound (Photograph2). Initially it appeared that these five wounds were due to three shots that hit at three distant sites on the body. But as per history given by the eyewitness a single shot was fired.

On careful examination of the direction of the wounds and by correlating the wounds (by keeping the body in a posture with knees semi flexed and right hand lying in between the right knee and the trunk) it was found that all the five wounds were in a single line. It was concluded that the single bullet resulted in multiple wounds. The bullet first hit the right knee and came out from its upper part then entered the dorsal aspect of right hand and came out of its palmer aspect and finally hit the



Photograph 1



Photograph 2

abdomen. On exploring the abdominal wound it was found that the bullet entered the abdominal cavity, went upwards and laterally and ruptured the anterior and posterior wall of stomach, then hit the spleen and ruptured the diaphragm and finally entered the left thoracic cavity. It was retrieved from the left 10th inter costal space near para vertebral region. About 1500 ml of clotted and liquid blood was found in the abdominal cavity and 500 ml of blood in the left thoracic cavity. The cause of death was hemorrhagic shock.

DISCUSSION

The present case is unusual as a single bullet resulted in multiple entry and exit wounds. Although reported in literature, the incidence of such cases is low. The autopsy surgeon should keep in mind the possibility of atypical firearm wounds. Multiple wounds, even at distant sites on the body may correlate to each other. This becomes more challenging in the absence of visit to the site of incidence and incomplete history of the case.

The present case highlights the potential dangers of inadequate care during firearm cleaning which resulted in the tragic death. Elfawal and Awad [1] have reported a study in which 76.4% accidental firearm deaths were due to faulty handling of firearms and in 70.6 % cases accidental shooting was done by others.

Easy access to firearms, constitute a true hazard in the community. Very few people survive incidents involving gunshot injuries. Lack of legislative restrictions on guns is often associated with higher fatality rates. [2] Increased control over procurement and possession of guns may help to limit such fatalities. [3,5,6]

Studies have indicated that reducing the availability, as well as cultural inacceptance of firearms will help to decrease the fatality rates especially among males. [1-4]

A study shows that physicians do not adequately document and interpret gunshot wounds, which may influence the treatment of the patient and have medicolegal consequences. It has been suggested that emphasis should be placed on undergraduate and postgraduate teaching for physicians to correctly identify, interpret and document firearm wounds. [7]

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RESPONSIBILITY AND LIABILITY IN CASES OF SUICIDE BY PATIENT IN HOSPITAL PREMISES

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ABSTRACT

It is not uncommon to see that a few patients commit suicide in hospital premises. What would be the responsibility and liability of Hospital Manager in such situations? In the light of increasing incidents of such suicides in hospital premises, all pros and cons of such situations are discussed in length. A few settled and unsettled cases are discussed with an aim to create a debate on the issue and settle it squarely.

KEY WORDS: Deaths in hospital premises, suicide in hospital, fall from height, distress deaths.

There are growing incidents of suicide by patients visiting hospital OPD premises, during transit, investigation, or while being admitted in wards. Persons visiting the hospital are likely to be under stress, though stress level may differ. In such incidents, whether some responsibility can be fixed on some one or all these cases should be treated as an '*incident by chance*'. These patients can be categorized / recognized as

1. OPD Visitor
2. Under observation though vitals and behavior are normal.
3. Under close observation Quarantine Period
4. Transit Patients, during investigations
5. Under constant observation, vitals require watch and close monitoring
6. under restrain
7. in Intensive Care Unit (ICU)

The level of watch in restrain, close watch, and ICU patients is much more and hospital staff has absolute control over the patient as relatives are not permitted. In situations like OPD, observation, transit, and during investigations, the person is usually accompanied by relative or attendant. The second option is shared responsibility and issue is at times difficult to decide. A few method of common suicide in hospital premises are mentioned below to high light the need to decide this issue.

1. Jumping from height in multistory hospital or wards
2. Hanging inside the hospital ward or in the premises

3. Consumption of Poisonous Substance / drug or self injection overdose
4. Self mutilation by easily available objects like fruit cutting knife, glass or bottles etc.

These are few cases in which patient died in hospital premises and brought to this hospital and few after scanning the public print media news items are discussed to give an overview and further serious thinking about planning and consequences of the situation.

Case 1

One 64 Years old Indian male committed suicide in a hospital by jumping from 3rd floor roof of the hospital. He was suffering from mental depression after retirement and was also having ischaemic heart disease. He was admitted in ICU of hospital when he jumped from 3rd floor. He died due to multiple injuries to head, chest and abdomen viscera. Sept 2002

Case 2

One person of 45 years suffering from heart ailment jumped from the 5th floor of a hospital and died due to multiple injuries. He could not bear the stress of his ailment and financial liabilities of the costly treatment.

Case 3

One person of 30 years was waiting to his turn in OPD of a hospital for surgical ailment, suddenly reached on roof top and jumped from the 7th floor died due to fall from height.

Case 4

One 57 years old male hanged himself in one nursing home. He was admitted with the complaints of stomach ache. Relatives lodged a complaint of negligence against the nursing home, and inquest under 174 Cr PC was conducted by Kolkata Police. [6]

Case 5

One person of aged 32 years hung himself inside the bathroom of one Govt. Medical College ward in June, 2003. He was admitted in the hospital one week before for abdominal operation. He hanged himself with dupatta around his neck from ventilator of bathroom. He also left a suicide note expressing his intentions to end his life and also pleaded that no body be held responsible for this incident. [7]

Case 6

One of the settled cases is Ravnat Singh Bagga v/s KLM Dutch Airlines [6] suggests that rendering of deficiency in services is to be considered and decided in each case, according to the facts of that case for which no hard and fast rule can be laid down. There are instances when patient consume poison substance in hospital premises. In some cases patient may inflict injuries to commit suicide

Case 7

In another settled case Kannan VR v/s Sree Sudheendra Medical Mission Hospital [5], patient admitted in ICU with high fever jumped from second floor of the hospital under the delirium and died. A case of negligence was registered and a suit was filed against the hospital.

The court decided that:

1. The occurrence was the result of lack of care of the hospital who under the law, was bound to take the required this care.
2. The acts of commission and omission attributable to a hospital which other wise do not amount to deficiency of services cannot be granted. Inefficiency, lack of due care, absence of bonafide, rashness, hate or omission may be the factors in rendering services.
3. Standard of care has to be maintained by the hospital. A hospital has to take care with respect to a patient who is admitted in the CCU (standard of care to be taken by the hospital in

not only confined to actual medical treatment care to the patient).It would also include care of his well being and welfare during the period of treatment .

4. Onus of proof: The burden of proof is on the complainant to establish negligence in the sequence of events
5. Complainant was compensated and hospital deemed negligent as, it was held that hospital did not discharge the duties as accepted norms. The ICU itself carries a meaning that special supervision was given to the patient due to his deteriorating condition. It is practically not possible to watch every outdoor and indoor patient in wards. ICU has close monitoring so responsibility has to be shared [2]. How a suicide becomes different in hospital premises as happens in office premises. In Public hospital, there is great rush and at times crowd is beyond control of the facilities and security personnel.

Deficiency in medical services means any fault, imperfection, shortcoming or inadequacy in the quality, nature and manner of performance which is required to be maintained under any law for the time being in force or has been undertaken to be performed by a person in pursuance of contract or otherwise in relation to any practice. A medical man rendering professional service for consideration is liable under consumer forum if he falls of short of the standard of a reasonably skilful medical person in his field [3].

The suicidal patient 's attempts to thwart the efforts of the physician and staff or even to actively resist lifesaving treatment becomes a resented and onerous burden to them [5]. To establish liability in negligence, the doctor/ hospital must owe duty to take care of the patient. Probably every physician can do more to detect suicide, take anti suicide action, and sensitize himself to the seriousness of the entire problem of suicide [5]. The relative or his family members should be warned about intense depression or self destruction.

These suicidal patients take advantage of transfer, shifting, mobilization of out of the ward investigations. It is usually either carefully planned or impulsive. Institutionalization in ICU or wards cuts off the patient from his known to circle and hospital

Hospital is responsible and should pay the damages for negligence - for and against

Factors in favor of punishment or damages	Factors against the damages
<ol style="list-style-type: none"> 1. Under absolute custody of hospital staff 2. It is preventable disease, doctor must recognize it. 3. He is ill and likely to be suffering from stress and its related problems so it has to be covered in treatment 	<p>It is a joint responsibility</p> <p>Every doctor is not trained in this Psyche evaluation and treatment is complaint oriented</p> <p>The contract and consent is for a particular illness</p>

culture appears artificial to him as affection and concern may be missing.

Hospital can be held responsible only if it is proved that person was under absolute care and protection of hospital staff. It is absolutely correct in cases where visitors are prohibited and hospital staff has sole authority over the patient. In situations where a person is under dual responsibility of hospital staff as well as of relatives, it is very difficult to decide the issue. In such case circumstances, attitude, behavior, and treatment advice play a major role in deciding the issue. It becomes very difficult to, assess the mood of patients in short meeting between doctor and patient due to disinterest on either side, or crowded OPD etc.

It is practically very difficult to put up a team examination in each and every case due to limited human resource. In cases of absolute control there is no escape from responsibility; lame excuses are unlikely to rescue the hospital and its staff. Only question, which may be raised is, why owner should pay the damages? let the concerned staff should pay for their negligent deeds.

In this types of cases, it should be a declared policy of the hospital that if any patient dies due to negligent act or supervision of hospital staff then

hospital will pay a nominal amount of 25% or like % (because hospital has employed such a person) of compensation and rest will be borne by the staff concerned. This kind of introduction will develop a sense of responsibility and more attentive behavior among relatives and hospital staff.

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ATTEMPT TO MURDER (Section 307 IPC) AND MEDICAL EVIDENCE A CASE REPORT

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ABSTRACT:

The investigating authorities often make heinous offences like u/s Section 307 IPC, without taking into consideration the medical evidence, by taking advantage of the legal loop-holes, causing undue harassment to the alleged accused while the medical evidence plays a pivotal role in establishing such cases in a court of law. The authenticity of medical opinion is discussed in this case wherein the offence u/s 307 IPC against the alleged accused was ordered to be cancelled by the court keeping in view the simple nature of injuries from medical evidence.

KEY WORDS: Dangerous to life, Medical evidence.

CASE HISTORY:

On August 14, 2004 at 12:10 PM, an injured male aged 24 years with alleged homicidal injuries was examined in the Casualty Department of Rajindra Hospital (Govt. Medical College) Patiala. He was conscious; Pupils were normal and reactive; B.P. 120/84 mm of Hg and Pulse 78 / minute; regular & good volume. The injuries were as follows:

1. Lacerated wound, 2 cm X 0.2 cm present on left ala of nose with fresh bleeding. Advised X- Ray & observation.
2. Alleged application of rod on the back. No visible external injury seen. Advised X-Ray.

The nature of injuries was to be given on receiving bed head ticket record through police. The probable duration of injuries was within 24 hours and the kind of weapon used was blunt.

Before the final opinion was given, it was informed that a case under Section 307 IPC had been registered against the alleged accused who approached the court. As desired by the Hon'ble court and on receiving request, written information was sent to the court that from the bed head record, the injured was discharged from the hospital the same day in a satisfactory condition after stitching of the wound on nose and doing medico-legal X-Ray for the injuries mentioned in the medico-legal report which showed no bony injuries and none of the injuries was on any vital part of the body.

On the basis of this partial opinion, the court stayed the arrest of the alleged accused and directed the in-charge of the concerned police

station to explain imposition of Section 307 IPC in this case and produce final opinion on nature of injuries, which on police request was given as follows: -

“After going through the bed head ticket, medico-legal X-Ray report and injuries noted on examination, the injuries are declared as simple in nature. Opinion regarding any danger to the life of the injured regarding application of blunt weapon as iron rod on head can not be given in the absence of the actual application of the said weapon on head”

After hearing both sides i.e. the applicant named as accused and the prosecution, the court ordered that it is of the considered view that alleged injuries attributed to the applicants were declared simple in nature by the medical officer, who medically examined the injured, as also by the medical board got instituted by the prosecution. So, the medical evidence indicates the commission of offence punishable u/s 323 IPC only. One fails to understand, as to why a minor scuffle has been blown out of proportion, which is a question mark on the conduct of the police. While conducting the investigation, S.H.O. of concerned police station shall remain cautious in such like cases, who should add heinous offences like offence under section 307 IPC only when the medical evidence indicates so and in these circumstances, on the face of it offence under section 307 IPC is not disclosed and custodial interrogation in the judgment of the court shall be abuse of the process of the law.

DISCUSSION:

The Indian Penal Code, 1860 (Act No. 45 of 1860) Section 307 defines the offence of “attempt to murder” as “Whoever does any act with such intention or knowledge, and under such circumstances that, if he by that act caused death, he would be guilty of murder, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine” The act as mentioned in this section and which can cause death of a person in the ordinary course of nature, in the medico-legal context involves:-

1. Parts of human body i.e. head, chest and abdomen with vital organs underneath like brain, heart, lungs, abdominal viscera or testes.
2. Use of any dangerous weapon or means as defined under Sec. 324/ 326 IPC i.e. “.... any instrument for shooting, stabbing or cutting, or any instrument which, used as a weapon of offence, is likely to cause death, or by means of fire or any heated substance, or by means of any poison, or any corrosive substance, or by means of any explosive substance or by means of any substance which it is deleterious to the human body to inhale, to swallow, or to receive into blood, or by means of any animal” which can kill a person.

The Investigating Officers, before establishing intention or knowledge and circumstances in criminal cases of heinous nature like attempt to murder u/s 307 IPC, should take medical evidence into consideration which otherwise is taken after registration of the criminal case against the alleged accused in case injuries are caused and the injured medically examined. Attempt to murder is a non-bailable offence often registered by police on the statement of the complainant which puts a question mark on the conduct of the police and undue harassment and mental torture to the alleged accused.

The role of medical evidence in administration of justice is undisputed. In large number of criminal cases, medical evidence plays

a pivotal role not only in solving the case but at times it is the key evidence before the court of law, on the basis of which justice is dispensed. The manner and type of medical evidence is of utmost importance in arriving at justifiable conclusions and avoiding its miscarriage.

For the investigating authorities, it is a difficult job to establish the intention or knowledge of the accused and sometimes the circumstances under which the act, which can cause death, was done. Under these circumstances, the medical evidence in the form of nature of injuries can well establish nature of the offence.

As remarked by the court, the registration of criminal cases u/s 307 IPC, often puts question mark on the conduct of the police when such heinous offences are added without medical evidence. It seems that there is an anomaly in the Indian Penal Code wherein criminal cases are registered without considering medical evidence in cases like this. This requires an urgent discussion of medical and legal experts on this section of law and if need be, the desired amendment.

CONCLUSION:

Medical evidence plays a key role in administration of justice both in criminal and civil cases. The manner and type of medical evidence provided to the court of law is of utmost importance in arriving at justifiable conclusions and avoiding miscarriage of justice. A mandatory provision in the legal system should be introduced wherein the investigating authorities will make heinous offences like offence u/s sec. 307 IPC only after taking medical evidence into consideration if the injured was medically examined

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IT TOO HAPPENS: TWO UNUSUAL CASE STUDIES

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ABSTRACT

A 54 years male admitted to the hospital with history of illness and stomach ache. He died suddenly after 3 days. The autopsy findings were suggestive of fatal injuries. The viscera were found positive for phosphorus.

Second case was 32 years male admitted to the hospital with the history of vomiting, headache, stomach burning and constriction of chest. He expired on second day. The post mortem findings were suggestive of throttling. Viscera were positive for aluminium phosphide.

CASE-I

Deceased Bhagwan Singh aged 32 years was admitted to the hospital on dated 18.02.2002 with the complaint of vomiting, stomach ache, *ghabrahat*, for which he was treated and at that time he remained conscious and added when he was asked that this complain started after taking tea and eating Ber. He also mentioned emphatically that he has not consumed any poison. The condition deteriorated after admission and the deceased died after 2 days.

Postmortem Findings: On external examination during postmortem evidence of cyanosis with sub-conjunctival hemorrhage in both the eyes with multiple abrasions and contusions on chest and neck were present. On internal examination petechial hemorrhage on internal organs with fracture of thyroid cartilage and ecchymosis of para-tracheal muscles were present. Moreover, left side ribs were found fractured with contusions of adjacent lung and intercostals muscles. The stomach finding revealed semi-digested food with reddish pasty material and Ber

seeds 2 in number. Mucosa severely congested and hemorrhagic. (Photographs 1 to 3)

Viscera Analysis: The preserved viscera was analyzed and found positive for Aluminium Phosphide.

CASE – II

Deceased Abdul Hafeej aged 54 years was admitted to the hospital in unconscious state with the history of ingestion of massage oil named 'Rogan Phosphorous' before three days of admission. On resuscitation he became conscious and narrated the same history. He died after 3 days.

Postmortem Findings: On examination both eyes were having sub-conjunctival hemorrhagic and patechial hemorrhagic on internal organs. The injuries were noted in form of multiple contusions, abrasion taking rail pattern on left deltoid region. Contusion on neck, right ear, with massive ecchymosis underneath the scalp on left temporo-parietal region as well as ribbon muscles of the neck (Para-tracheal) and right sternocleidomastoid muscle with right cornua of thyroid cartilage found



Photograph 1



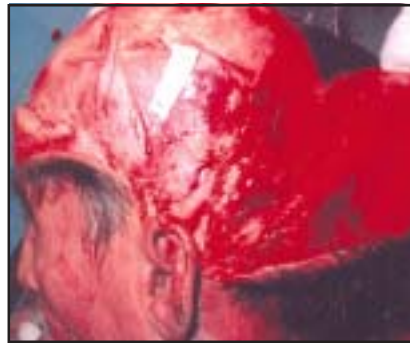
Photograph 2



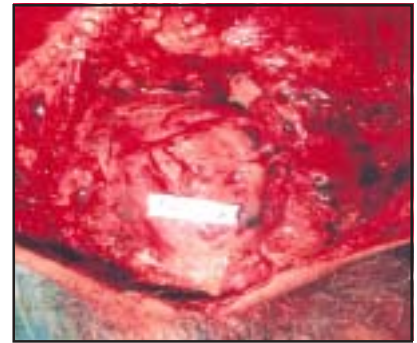
Photograph 3



Photograph 4



Photograph 5



Photograph 6

fractured. The stomach finding revealed bloody liquid about 20 cc with mucosa severely congested and hemorrhagic. (Photographs 4 to 6)

Viscera Analysis: The preserved viscera was analyzed in the department and found positive for phosphorous.

DISCUSSION

Both the cases are of similar nature having similar finding of cyanosis, asphyxia with multiple external and internal injuries on the body especially on trachea indicating throttling.

Similarly the stomach findings were of suspected poisoning which were confirmed on chemical examination.

Although the poisoning was confirmed in both the cases, the cause of death was ascertained as homicidal throttling based on the specific findings of violent asphyxial death. Subsequently the hospital record was reviewed but no injuries were found to be incorporated in the hospital record.

On subsequent query from the medical officers they did not refuse the possibility of injuries and admitted that they might have ignored these minor and simple looking injuries in view of the

patient's grave condition and started the treatment on the line of poisoning on the basis of history given by the victim and family members as well as on the associated sign and symptoms. Ultimately the patients succumbed to death.

CONCLUSION

Both the cases are unique in nature and very rarely seen. It is also found very unusual that the person dying also sometimes does not give the correct history. Such type of cases needs skillful vision and meticulous investigation to decide the cause of death.

Since the patient died during hospitalization and treatment a possibility is raised by the police and doctors that, can these type of injuries be sustained during resuscitation and endo-tracheal intubations or not?

This is the question to be discussed by the learned forensic experts otherwise it will be not possible to differentiate between homicide, suicide and accident.

So now, the paper is open for the discussion and to know the opinion of learned experienced and senior Medico legal experts.

INSTRUCTIONS TO AUTHORS

CONTRIBUTIONS:

Unpublished original manuscripts, written in English should be sent to: Dr. R.K.Gorea, Editor, JIAFM

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