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# Violence of Undetermined Origin: A Case Report

# \*Murkey P.N, \*\*Tirpude B.H, \*\*\* Pawar V.G, \*\*\* Shende S.A, \*\*\*K.Suken Singh, \*\*\*Keche A.S.

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### Abstract

On 09/02/08, 20 years old married women, primigravida, with her husband after attending regular Antenatal checkup at PHC at Hinganghat sector, was going back to her home met with an accident, then immediately taken to Government hospital near to the accident site, from their referred to Kasturba Hospital, Sewagram. She gets admitted and treatment started but did not survived during the treatment. The investigating officer made Panchanama and body was sent for postmortem examination. The husband was crying very agonily and saying that this was their first issue in their family. Though 7 people were present in the auto rickshaw, only my wife has injured seriously and others were having minor injuries, added to that says-"Kaal ala hota, pan vel aali navthi, devane mala pan ka barobar nele nahi" Case has been explained in details.

### Key words

Primigravida, Investigating officer, Panchanama, Postmortem.

### Introduction

Accidents are epidemics in civilized

#### Reprint requests: Dr. P.N. Murkey

Associate Professor, Department of Forensic Medicine & Toxicology, Mahatma Gandhi Institute of Medical Sciences, Sewagram Wardha, Maharashtra. world; and our country is not an exception of this universal trend, and has witnessed a steady increase in the accidental trauma. Trauma accounts for 8% of all deaths in India. Every year in India, about 1, 40,000 individuals die in accidents<sup>(1)</sup>

In urban life, 75% of abdominal trauma follows blunt injury. Greatest difficulty in their management lies in the timely diagnosis other causes are fall from height, sports accidents, martial arts, athletics like high jump, mountaineering<sup>.(2)</sup> The large area of the anterior abdomen occupied by the intestine provides a target for perforation with consequent chemical or infective peritonitis. <sup>(3)</sup>

The liver and especially spleen may bleed extensively causing a haemoperitoneum Closed or blunt injury to the abdomen is common from both accidents and assault. The liver, intestine, spleen and mesentery are more vulnerable. <sup>(3)</sup>

#### **Case Report**

A,20 years married primigravida, alleged to have sustained injuries in a road traffic accident due to hit by truck, while she was travelling by auto rickshaw, then immediately taken to Government hospital near to the accident site, from their referred to Kasturba Hospital, Sewagram. She gets admitted and treatment started but unfortunately she did not survive . As body comes for postmortem, external and internal examination has been carried out.

#### **External examination**

External examination shows averagely built nourished female body with rigor mortis present all over the body and postmortem lividity present on the back side except at the pressure points with no signs of decomposition seen. Eyes were closed with pupils fixed and dilated, mouth closed.. Reddish coloured blood like stains present at places near the natural orifices. Multiple abrasions and contusions were present mainly on the abdomen, right lower limb, right hand, anterior aspect of the left knee joint, various dimensions varying from 8cm to 5cm ,4cm to 3cm and 3cm to 2cm direction also varies.

#### Internal examination

On opening the skull, contusion present over the vertex with sub scapular hematoma 7cm to 5cm in size weight about 80gms involving the both parietal and occipital region. Brain matter was edematous. No hemorrhages seen in the ventricular region.

On opening the pleural cavity, lungs were pale, on cut section no oozing of blood seen and lungs were congested. Heart was normal in size and shape with no hardening and thickening of the coronaries and on cut section shows no blood in the ventricles.

Abdomen was distended, linea niagra and stria gravid arum present on the anterior aspect and breast was pendulous with both nipples were prominent. On opening the abdomen, about 1.5 liters of thick purulent blood was present in the abdomen. Liver shows the two lacerations on the anterior aspect on left lobe about 6cm to 2cm to 4cm to 3cm in size parenchymal deep, vertical in direction, reddish colour blood clot adherent at the site of laceration. Spleen shows laceration at its medial aspect of size of 3cm to 2cm, parenchymally deep obliquely direction, on cut section pale.

Both kidneys were normal in size and shape on cut section-Cortico-medullary ratio was normal and pale. Mesentery attached to the large intestine was contused.

On opening the distended gravid uterus, retro placental blood around200ml present with some blood clots. placental weight was of 350gms with single female child showing no signs of life was present. Length of the baby was 46cm and cord length is 42cm. Head circumference was 32cm and chest circumference was 28cm, weight of the baby with placenta was 2900gm. Eyebrows and eyelashes of the baby were present. Blackish colour hairs present on scalp with planter creases present on both feet. Presentation of the baby was vertex with.

As the case reveals all positive findings, the autopsy surgeon has no doubt in giving the final cause of death.

The final cause of death in this case is "Hemorrhage and shock as a result of injury to the organs liver and spleen".

#### Discussion

Injuries of the abdominal viscera caused by blunt trauma are particularly common in civilian life. The blunt trauma differs from penetrating trauma, as the different organs are characterized by injured. The solid organs are more likely to be damaged by compression from blunt straining than the hollow viscera. <sup>(4)</sup>

The outstanding features of injury to solid organs are the hemorrhage and shock, while the in hollow visceral injury shock follows with the development of peritonitis, as the intestinal track has certain fixed points, which are vulnerable to rupture.<sup>(5)</sup>

In open cases of abdominal trauma the clinical manifestation of diagnosis and management will be easier but closed cases of trauma, offers a great challenge to the treating surgeons.<sup>(6)</sup>

Sometimes it may escape detection or lead to an error in diagnosis from medico legal point and same is often true with the autopsy surgeons<sup>(7)</sup>

Blunt force injuries of the pregnant uterus are rare. In one case, 39 years old women, five months pregnant was run over by an automobile sustain fractures and injuries present. Violence has exerted pressure on her lower portion of pregnant uterus, rupturing the fundus and amniotic sac which is three and half inches long which fetus still attached to placental site. Death occurred as a result of profuse intra abdominal hemorrhage.<sup>(8)</sup>

The most common fatal sequel to intraabdominal trauma is hemorrhage from any of the contained organ. The spleen and mesentery bleed most copiously and quickly, though there can be delay of many hours in serious symptoms may seen.<sup>(9)</sup>

#### Conclusion

Our aim to present this unusual case presentation is to alert to the surgeons and gynecologist to adequately evaluate the cases of blunt trauma abdomen as injuries to organs like liver, spleen, kidney leading to hemorrhage (60%) was common cause of death. The manner of death cannot be ascertained from the visceral injuries alone. As infection is a major cause of mortality, sustained efforts to control infection can reduce the mortality. Along with this one of the suggestions to be followed for everyone is that not to drive so carelessly which can do disaster for any others family or community, which gives direct massage to society to follow the road traffic rules and safe driving to minimize such incidences.

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Photograph showing the liver lacerations



Photograph showing the spleen laceration



# Medico Legal Aspects of Homicide Investigation

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#### Abstract

In present day world due increase crime rate, at almost a crime ever 3 minutes in our country, it is essential for the forensic experts to have extensive knowledge of patterns of crime, mode and manner of crime and scientific method to detect it and bring the accused to justice in fastest possible time. In the entire process of administration of justice system only the forensic expert is a medical and medico legal man playing very curial role in solving crime mystery. Unless he is well versed with all steps of justice system he cannot do justice to his subject forensic medicine in particular and society. In general... Even if one crime case is solved and accused brought to justice hundred crimes can be prevented.

## Key words

Homicide, injuries and autopsy

Forensic medicine is the application of the science of pathology to the needs of law and justice, in trial of sudden, violent deaths and unnatural suspicious deaths. This definition is not only applicable to criminal cases but applied also to all kinds of life or accidental insurance, employee's compensation acts and other civil procedure disputes.

The forensic medicine has to deal with

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Professor & Head, Department of Forensic Medicine, Prathima Institute Medical Sciences Nagunoor, Karimnagar – 505 417, A.P. E-mail: naidutkk.@yahoo.com. a wide spectrum of deaths. He sees deaths due to suicides, homicides, accidents and also the sudden unexpected and unwitnessed deaths. As Adelson has pointed out while there is only one way to be born, there are many ways to die. To those people who have regard and respect of human life, the present situation is tragic and pitiful spectacle. While the forensic expert is interested in finding the cause manner and time since of death in all varieties of that caused by violence cases. particularly these type of cases which attract the public and news agencies attention, throwing a great responsibility on the shoulders of investigating officers and the forensic expert.

Every one is aware that medicine is a social science which deals with the health of the human being, prevention of the disease and treatment of the sick and the injured. In homicide there is violence, brutality and criminality. Homicide and medicine are closely associated with one another in the work of forensic medicine department. His primary duty and responsibility in such cases is not only to find out the cause, time and manner of death, but also to search and preserve evidence which gives any clue for the apprehension of the offender. Many medical officers feel that their duty is only to conduct the postmortem and to give the cause of death. Medical officers should give guidelines to the investigating officers in constructing the scene of the crime or in giving the clue for the identification of the offender such as foreign hair, buttons and stains etc. on the clothing and the body. But a trained forensic expert realizes the importance of preserving trace evidence that present on the dead body.

### Present System of Investigation

Under the present system of investigation, the forensic expert is not called to the scene of crime. Our system of medico-legal investigation is far from satisfactory. A sub-inspector of Police is always busy as he is entrusted with multifarious duties and when he gets first information report, he passes on the preliminary investigation to a head whose educational constable qualification and scientific knowledge are not particularly high. He gathers some witnesses either by force or by persuasion and there may be some witnesses, who are not willing to talk to him. On the other hand there are some witnesses who readily give false statements for their own benefit and mislead the investigating officer. Under such circumstances, if a forensic expert is requested to come to the scene of crime along with first investigating agency; he will guide the investigating officer to approach in a scientific way. He will observe and collect the material scientifically and analyze and draw inferences or produce proof of facts. Hence a forensic expert with his sound scientific knowledge can render valuable service at the scene of crime. It is not the present first investigating agency which is at fault. It is our system of investigation which is at fault. We are not keeping pace with the changing environment, civilization and pattern of crime. The office of the forensic expert is an obscure one in the present day. It does not attract the medical man or government or the politician. Financial support and staff pattern is far from satisfactory. The importance of the forensic medicine in the present day is not fully recognized by the government and the society. Consequently he is unable to import his scientific knowledge in the interest of justice.

### Some Aspects of Killing

Every one is aware, that the homicides are on the increase. As Bernard Shaw aptly stated that evil is the product of circumstances. At present in India, the main causes contributing to criminal violence are property interests, broken homes, linguistic problems, faultily marriages, poverty, starvation and political differences. All of us desire to live in a decent orderly society administered by honest, energetic officials, and a sincere and capable judiciary. When a murder takes place, many of us react vigorously and respond promptly to search the offender and to punish him. But there are some people, who will hide the offender and allow false accusations to be made on an innocent person. A single police officer alone cannot investigate the case quickly, effectively and efficiently. Every citizen should help the first investigating agency. The medical officer, the various experts and even the lay public should associate themselves and work in co-ordination and co-operation to give their knowledge for that noble cause of "The defense of the innocent and the punishment of the guilty". At present we are working in watertight compartments. We should really plan a medical examiner system that is now current in the United States of America with excellent results.

When a forensic expert participates in the investigation of a known or suspected murder, he functions as a member of a team of experts. The police detective is faced with the problem of tracing the accused and apprehending the suspects and getting information from the witnesses. Similarly the experts like the firearm expert, finger print expert, forensic expert, radiologists, chemical examiner, serologist, physicist etc., may be called into action in the investigation of a murder. In every case of murder and unnatural death, the services of the forensic expert are necessary. He has to prove the cause of death and demonstrate that the death was due to violence. Further he has to extensive scientific knowledge far beyond this and answers various questions. When an autopsy is done on a case of death due to injury caused by weapons, he has to find answer to the following questions: (1) was death due to injury caused by the alleged weapon? (2) Whether the person died before or after the injury? (3) What were the direction of the wound and the position of the assailant to the victim? (4) were there multiple wounds and if so which of the several wounds would have been responsible for the death? (5) What type of weapon was used, was it heavy or light, was it single edged or double edged and what was the length of the weapon? (6) How long person have lived after receiving the injuries? (7) Was there any disease which was contributory or responsible for death?

#### **Necessity of Performing Autopsy**

The forensic expert is often asked by his colleagues or lay persons, who are not aware of the worries o the people actively engaged in homicide investigation, why an autopsy should be carried out on an 'open and shut case, when it is known that the death was due to violence, the suspect had confessed, and the witnesses were there to substantiate. The forensic expert never treats a case as 'open and shut'. Even if the commission of crime is established with certainty, it is mandatory to perform an autopsy to substantiate the truth of the confession. The dead body will not lie. The autopsy constitutes a source of strength and not of weakness. It clarifies and illustrates evidence and so remains an invaluable procedure in the investigation of homicide. False statements and confessions due to fear are not rare in India. Moreover, at the time of trial, the confessions made by the accused or the witnesses may be retracted. As the dire penalties for murder vary from long-term imprisonment to death, it is necessary that a complete autopsy be performed on all cases of death due to violence. Incomplete or partial autopsy has no place in medico legal work. As pointed out by Hudson necropsy is the last court of a trial solves the mystery of death.

Long experience has taught the medical person, that there are some medico-legal masquerades. Many deaths from violence produce no external injuries or bleeding, but death might occur due to injuries to internal organs. Similarly, there may be no injuries, only minor ones externally, but the victim could have died of some natural cause, like coronary occlusion or cerebral thrombosis and hemorrhage. Deaths from natural causes occur under such suspicious circumstances, as to suggest violence. Hence, only the forensic expert can distinguish between deaths arising from disease and those arising from violence. Sometimes, a homicide may be deliberately arranged so as to suggest suicide or accident and the converse is also possible. Many a time railway accidents are brought as cases of homicide and homicides described as accident. The forensic expert has to examine carefully the scene of crime and perform autopsy meticulously and confirm the truth or falsity of the statements given by the witnesses.

#### Forensic Medicine in the Court

The forensic expert is a fact finder and not a judge of facts. He cannot postulate the motive behind the trigger of a firearm. His duty is to present carefully the facts in the court in order to help the judge to reach a verdict. Many years ago Bourdel, a French medico-legal expert wrote "If the law has made a physician a witness, he should remain a man of science; he has no victim to avenge, no guilty person to convict and no innocent person to save". A forensic expert must bear testimony within the limits of science and be an impartial witness.

## Conclusion

In our present system the forensic expert is called by the court as prosecuting witness, though he is an independent impartial witness. They appear neither for the prosecution nor the defense. He takes no sides. His main duty is to present the scientific evidence from the autopsy table and the microscope to the court, un-emotionally, deriving nothing, withholding nothing. It is dangerous to get a remark from the judge, that a particular medical officer is hostile. His sole aim of giving medical evidence is to help the judge and to reach a just verdict. The forensic expert testify in a straight, unbiased, unprejudiced and balanced manner he will make a unique contribution to the administration of justice, which is the keystone of all democracy.

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### Legal Dictums

Justice delayed is justice denied Justice hurried is justice buried Justice protected will protect Ignorance of law excuse no one Be you ever so high, the law is always above you.

### Justice Verma

# Mercury Exposure in Indian Environment due to Coal Fired Thermal Power Plants and Existing Legislations- A Review

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## Abstract

Coal fired thermal power plants (TPPs) are the second largest source of mercury emission in India. Almost 73% of energy is obtained from TPP which uses about 220 millions tonnes coal/year. Coal contains mercury (Hg) naturally and its combustion in the boilers to generate electricity causes release of mercury in to the environment. A typical 100 mw TPP can emit over 10kg of mercury in a single year. Once Hg reaches to the environment it never breaks down and persists in the environment, cycling through land, air and water. Low level exposure of Hg may cause permanent damage to the central nervous system (CNS). At higher levels, Hg can damage vital organs such as lungs and kidneys.

Mercury has been the focus of regulatory activity because of its documented toxic and carcinogenic effects, as well as its persistent prevalence in the environment. Since mercury is volatile and readily mobilized, and often travels great distances before being deposited, regulatory concern about the **Reprint requests: Prashant Agrawal** 

Senior Research Fellow, Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, U.P. Phone-09451984349, Email: prashantimsbhu@yahoo.co.in environmental impacts of mercury appear to be quite justified.

#### Keywords

mercury, legislation, coal, Thermal power Plant.

## Introduction

Mercury (Hg) is a naturally occurring, highly volatile heavy metal. It is found in trace quantities throughout the environment - rocks, soils and the oceans. Being an element, mercury never breaks down but persists in the environment, cycling through land, air and water. Mercury can exist in the environment in elemental, organic or inorganic forms. According to the International Chemical Safety Council of United Nations, an organic form of mercury (methyl mercury) is one of the six most serious pollution threats to the earth. While most of the mercury released into the environment by human activity is in either elemental or inorganic form, biological processes convert inorganic mercury into highly dangerous forms of organic mercury, such as methyl mercury. This form is the most harmful to people and wildlife because of its ability to take part in biochemical reactions and accumulate in the food chain.1

Prashant Agrawa I at el. Indian Journal of Forensic Medicine and Pathology. April - June, 2008, Vol.1, No.2

# Health hazards Due to Mercury

Mercury is a potent neurotoxin. Even at extremely low levels of exposure, it can cause permanent damage to the human central nervous system. The addition of even 0.9 grams of mercury is enough to contaminate a 25-acre lake. At higher levels, mercury can damage vital organs such as lungs and kidneys.

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.<sup>2</sup>

Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The Environmental Protection Agency<sup>3</sup> (US EPA) has determined that mercuric chloride and methylmercury are possible human carcinogens

Health hazards of mercury to young children- Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk. Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, in-coordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.<sup>2</sup>

Besides affecting human beings, it also increases morbidity and mortality among fish, wild animals and birds, causing ecological imbalance and economical loss. In several areas of the United States, concentrations of mercury in fish and wildlife are high enough to be a risk to wildlife.

#### Mercury in coal

The mercury content of coal produced by different mines varies widely according to the location. A study by K.C. Sahu<sup>4</sup> shows mercury content in a coal sample as 0.11 ppm. According to Mishra et al,<sup>5</sup> the conc. of Mercury in coal ranges from 0.01 to 1.1 ppm in Indian coals against up to 20 ppm in Russian coals, 0.2 to 2.0 ppm in Belgium coals, 0.03 to 1.3 ppm in Canadian coals and 0.01 to 2.0 ppm in American coals.

A World Bank document in the year 2000 on the National Thermal Power Corporation (NTPC) showed results for mercury concentrations in coal analysis done by NTPC in the range of 0.11 to 0.14 ppm while another study of coal analysis, done by the Roorkee University, India, showed mercury to be in the range of 0.8 to 11.4 ppm. The Central Pollution Control Board<sup>6</sup> (CPCB) conducted a study on 'Mercury balance in thermal power plants'. The CPCB analyzed 11

coal samples and found the average mercury concentration to be of 0.272 ppm (ranges between 0.09 to 0.487 ppm).

## **Coal Fired Thermal Power Plants**

Coal fired thermal power plants are the largest source of electricity generation in India. More than two-thirds of India's power supply (73%) is provided by all the 75 coal-fired power stations. Thermal power plants are currently using about 220 million tonnes of coal per year, which account for about 75 per cent of the total coal production.

India is the third-largest producer of coal in the world. Coal is the most abundant fossil fuel resource and is the primary fuel for energy in India. The installed capacity of coal-based electricity generation has increased from 800 MW in 1973 to 50,000 MW in 1994-95 and is expected to go up by another 50,000 MW in the next 15 years. The demand of coal for thermal power stations will increase year after year.<sup>7</sup>

Most of India's coal is characterized by low trace element concentration. The quality of coal depends upon its rank and grade. Indian coal is of mostly subbituminous rank, followed by bituminous and lignite (brown coal). The ash content in Indian coal is approximately 35 to 55 per cent.<sup>4</sup>

# Environmental exposure of mercury due to coal based TPPs

Mercury distribution in the environment has been a focus of scientific attention because of the potential health risks posed by mercury exposure. India is one among the world's most active mercury industrial centers. Coal fired thermal power plants are the second largest source of mercury emission in India<sup>8</sup>. Mercury is released into the air by burning fossil fuels (coal) in thermal power plants. In the process of combustion mercury is not used but gets released and is further accumulated, as mercury remains persistent in the environment

A typical 100 megawatt thermal power plant can emit over 10 kg of mercury in a single year<sup>7</sup>. About 200 metric tonnes of toxic mercury escapes from industrial chimneys and effluents each year in India. Recent studies suggest that the total global atmospheric mercury burden has increased between 200 and 500 per cent since the beginning of the Industrial Age. Reports also indicate that the levels of mercury in rivers, coastal waters, and soil and food items are way above acceptable levels in India.

Mercury's presence in air and water has increased dramatically in the past century owing to emission from thermal power plants. The total mercury pollution potential from coal in India is estimated to be 77.91 tones per annum, considering average concentration of mercury in coal as 0.272 ppm. About 59.29 tones per annum mercury is mobilized from coal-fired thermal power plants alone. The mercury emanating from the thermal power plants' stacks is 58.05 per cent gaseous and 2.4 per cent in particulate form. About 32.5 per cent is retained in the ashes (fly ash and bottom ash). The remaining 7.05 per cent could not be accounted for.

Coal contains mercury as a natural component along with other elements in trace amounts (0.04- 0.7 mg/kg)<sup>9</sup>. As the coal is combusted in the utility boiler,

mercury is vaporized and released as a gas. Pollution controls employed by utilities to curb other pollutants are not effective in removing mercury. At present, there are no commercially viable control technologies for mercury. As a consequence, this highly toxic form of air pollution continues to go largely unabated. Thus coal becomes a repository of toxic metals. For example, a super thermal power plant consuming 8 million tones of coal containing x grams per tone of any mercury will pump into the surrounding eco system 8x million grams of the mercury.

Thus, mercury being persistent in the environment, its presence in the air in this amount could enter bodies through the nasal route and prove a great threat to people, especially those living in the vicinity of these thermal power plants. The 75 thermal power plants generates about 65-75 million tonnes of fly ash. In India, mercury is concentrated as 0.1 ppm as a trace element in the fly ash<sup>10</sup>. Therefore, the generated fly ash is a matter of huge concern because of its environmental impacts. This fly ash is transported to the ash ponds near the Thermal Power Plants by wet deposition method. These ash ponds affect the local environment. The impact can be described as-

- Leaching of mercury into surface water and ground water
- Accumulation of mercury in soil and plants around ash ponds

### Mercury in the Indian Environment

Fewer studies have been done to estimate the presence of mercury in the environment surrounding thermal power plants. A study on mercury contamination in the Singrauli area was done by the Industrial Toxicology Research Centre to assess the environmental risk to human population related to mercury contamination in the Singrauli area. It is an epidemiological study, tracing impact of mercury emissions from thermal power plants and fly ash on the environment and mercury levels in the local people's bodies. The probable source of mercurv contamination has mostly been food items. The study shows that the proportion of mercury in the blood samples was high in the population of Singrauli region.

The five giant super thermal power plants in Singrauli area, which supply 10 per cent of India's power, stand responsible for 16.85 per cent, that is, 10 tones per annum, of the total mercury pollution resulting from power generation.

Another study by researchers concludes that serious mercury pollution is occurring in GBP reservoir and other surface waters of Singrauli, posing a grave threat to the health and livelihood of the population. The major cause of pollution, which appears in the study, is the deposition of mercury transported via the air route from the emissions of large thermal power plants.<sup>11</sup>

Pervez and Pandey<sup>12</sup>, 1994 found presence of Hg in Hasdeo River water samples. This river is being contaminated by the ash pond discharges of Thermal power plant located in Korba.

### Permissible limits for mercury

Mercury Emission from massive coal consumptions enhances the level of mercury more than 1ppm in soil and

more than 10 ppm in ground water and ponds <sup>12</sup>. Govt. of India is reviewing the occupational exposure standards of 0.1 mg/m<sup>3</sup> of air, set up by Occupational Safety and Health Administration, USA for its implementation in our country. There is a need to reduce mercury air emissions from coal-fired power plants.

Bureau of Indian Standards (BIS) and World Health Organization (WHO) limits the concentration of Mercury only up to 0.001 ppm in drinking water and 0.05 mg/Kg in soil. The maximum allowed concentration of total mercury in fish is 0.50 ppm in India<sup>13</sup>. The WHO guideline set for mercury intake by fish is 0.47 mg/kg/day, while the limit set by EPA is 0.1 mg / kg /day, which is one fifth to that of WHO.

Mercury free alternatives to generate electricity- Alternatives to fossil fuel power plants include nuclear power or solar power and other renewable energies. Renewable energy technologies include solar power, wind power, hydroelectricity, micro hydro, biomass and biofuels. According to the National Thermal Power Corporation, coal is used for approximately 62.3% of India's electric power generation; oil and gas account for 10.2%; hydropower contribute 24.1%; nuclear, wind, and other power generation methods contribute to the remaining 3.4% of the power generated.

## Environmental Legislations in India

In 1976 Parliament passed the 42<sup>nd</sup> Amendment to the Constitution and India became the first country in the world to provide protection and improvement of the environment in the Constitution itself. The Ministry for Environment and Forests is the focal point in the Government of India for all matters relating to the environment

Legislative control of environmental pollution caused by toxic mercury and the protection of workers engaged in the related industries involves:

- Laying down a set of rules on the expert recommendations to control environmental pollution.
- \* Adopting international conventions and recommendations concerning the prevention of occupational risks.
- Observing the codes of practice and guides on prevention.

S No	Acts and Rules	Brief description			
1	The Water (Prevention and Control of Pollution) Act, 1974.	To provide for the prevention, control and abatement of water pollution; and the establishment of central and state boards to implement that objective.			
2	The Environment Protection Act, 1986.	Provides for the protection and improvement of environment			
3	The Workmen's Compensation Act, 1923.	Provides for compensation payment by certain classes of employers to their workmen- Diseases caused by mercury or its toxic compounds are included			
4	The Factories Act [Act No. 63 of 1948] as amended by the Factories (Amendment) Act, 1987.	Covers all the aspects of health and safety of workers. Permissible limits of exposure to mercury in the work environment.			
5	The Public Liability Insurance Act, 1991.	Provides for public liability insurance for the purpose of providing immediate relief to the person affected by accident.			
6	The Municipal Solid Wastes (Management and Handling) Rules, 2000.	Regulates municipal solid waste- mercury in ground water, composts and leachate.			

## Conclusion

Thermal power plant emissions have added new dimensions to the nature. Coal fly ash disposal on land affects soil, vegetation surrounding Thermal power plants and ground water around disposal pond. Toxic mercury present in coal fly ash poses potential risks to soil and water ecosystems. Thus its solubility, mobility and bioavailability have become a matter of concern in recent years. A regular monitoring and clinical surveying of subjects residing in the power plant areas is required. There is also a need for further and in-depth studies for accurate appraisal of the situation. As coal is used in Thermal Power Plant, mercury pollution is bound to happen till the existence of TPP, even if strict pollution control measures are taken. Therefore, all other non-polluting methods of power generation should be encouraged against TPP

The main problem of our legislations lies in the poor level of implementation by the various implementing agencies. If the legislation and standards were properly implemented, half of India's environmental problems would be solved.

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# Assessment of Gestational Age from Hand and Foot Length

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# Abstract

Determination of gestational age is important in civil and criminal cases. Though a reasonable assessment of gestational age can be made by measuring physical parameters such as crown-heel length, weight of fetus and by noting morphological features, organ development and appearance of ossification centers, an alternative parameter is desirable in some instances. The purpose of the present study is to determine the accuracy of fetal hand and foot length in estimating gestational age. The result of present study reveals high correlation of fetal hand and foot lengths with gestational age and these parameters could be utilized to estimate gestational age.

# Key words

gestational age, intrauterine age, fetus, foot length Assessment of gestational age from hand and foot length

## Introduction

Determination of gestational age is important in civil and criminal cases. Fetal age is usually estimated by measuring physical parameters such as crown-heel length & weight of fetus and by noting morphological features, organ development and appearance of ossification centers<sup>1-3</sup>. Other method for evaluation of age includes fetal biometric measurements by ultrasound. The

Reprint requests: Rajesh Bardale Lecturer, Dept. of Forensic Medicine Govt. Medical College & Hospital Nagpur 440 003,E-mail: bardalerv@yahoo.co.in parameter includes fetal crown-rump length, biparietal diameter, head circumference, abdominal circumference, femoral length, foot length and appearance of fetal heel ossification centers <sup>4-7</sup>. Though, a reasonable assessment of gestational age can be made by foresaid method, an alternative parameter is desirable in some instances, especially in cases of severe hydrocephalus, anencephaly, short limb dysplasia, postmortem destruction or in mutilated cases. Kumar et al<sup>8</sup> showed that the fetal hand and foot has a characteristic pattern of normal growth. These authors proposed that the fetal hand and foot length could be utilized to estimate gestational age. The purpose of the present study is to determine the accuracy of fetal hand and foot length in estimating gestational age.

# Material & methods

A prospective study was conducted at Government Medical College and Indira Gandhi Govt. Medical College, Nagpur through 2004 to 2007. A total 123 normal human fetuses were included in the study. The gestational age ranged from 12 weeks to 40 weeks. The samples were drawn from medicolegal autopsy cases and fetuses obtained from department of Obstetrics & Gynecology. The parameter taken for study includes gestational age, crown-heel length, foot length and hand length of fetus. All measurements were recorded in centimeters and on the right side as per method described by Kumar et al (8). Fetal foot length was measured in the planter and longitudinal plane from the posterior heel to the tip of longest toe and hand length was taken on palmer surface in longitudinal plane from wrist crease to the tip of the middle finger. The collected data were analyzed with regression analysis.

#### Results

A total of 123 cases were studied consisting of 70 male and 53 female fetuses. The classification of fetus in agewise manner is shown in table 1. A nomogram of fetal hand and foot dimensions, standard deviation and percentile distribution versus gestational age is given in table 2 A & 2 B. A statistically significant linear relationship was found between fetal hand length (HL) and gestational age (r = 0.978, p < 0.0001) (fig 1). Similarly a statistically significant linear relationship was found between fetal foot length (FL) and gestational age (r = 0.975, p < 0.0001) (fig 2). The correlation coefficient, intercept and standard error is presented in table 3. The gestational age of fetus in weeks from hand and foot length can be obtained by the equation given in table 4. The standard error of estimate for hand length is 1.62 and foot length is 1.76.

#### Discussion

Obstetricians have been using the fetal foot length to estimate gestational age. The period of gestation by this method appears to be in agreement with other ultrasound parameters (6, 7). The result of our prospective study provides normative data on fetal hand and foot growth throughout the gestation. The data of present study is in accordance with those of Kumar et al. Fetal hand and foot lengths have been found to highly correlate with gestational age and therefore these parameters could be utilized to estimate gestational age.

The utilization of fetal hand length and foot measurements will serve as a useful adjunct data for estimation of age in reliable manner. Moreover, it's utility becomes apparent when other parameters of fetus cannot be utilized due to disease, deformity or destruction by injury or postmortem process or mutilation. Apart from estimation of gestational age, the utilities of foot length measurements have been shown by other studies. Pospisilova-Zuzakora (9) used foot length to determine body length of fetus whereas in a study conducted by Embleton et al (10), it was concluded that foot length of fetus is a reliable and reproducible predictor of nasotracheal tube length, especially in premature babies.

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		$\mathcal{O}$	0
Period of gestation	No. of fetuses		
(in weeks)			
12-16	7		
17-20	26		
21-24	18		
25-28	20		
29-32	15		
33-36	18		
37-40	19		

Table 1: classification of fetuses in various age groups

Gestational age	Length (cm)		stational age Length (cm) Percentile (cm)		
(in weeks)	Mean	SD	5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>
12-16	1.4	0.690	0.8	1	2.17
17-20	2.52	0.421	1.85	2.6	3
21-24	3.31	0.350	2.88	3.2	3.76
25-28	4.81	0.377	3.6	4.3	4.6
29-32	4.81	0.396	4.27	5	5.43
33-36	5.85	0.427	5.25	5.9	6.54
37-40	6.32	0.230	6	6.3	6.71

Table 2 A: nomogram of fetal hand size throughout the gestation

Table 2 B: nomogram of fetal hand and foot size throughout the gestation

Gestational age	Length (cm)		m) Percentile (cm)		)
(in weeks)	Mean	SD	5 <sup>th</sup>	$50^{\text{th}}$	95 <sup>th</sup>
12-16	2.14	0.884	1.3	1.8	3.17
17-20	3.21	0.540	2.27	3.15	4
21-24	4.26	0.451	3.78	4.1	4.96
25-28	5.09	0.255	4.6	5.1	5.5
29-32	5.82	0.495	5.27	5.6	6.53
33-36	7.10	0.494	6.37	7.1	7.8
37-40	7.56	0.417	7.09	7.5	8.2

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Table 3: regression statistics derived from gestational age (in weeks) versus hand & foot lengths (in cm)

Variables Multiple R R square		Intercept	Slope	Standard	
					error
Hand length	0.978	0.958	6.5582	4.9504	1.62
Foot length	0.975	0.950	4.9381	4.3383	1.76

Table 4: formula to determine gestational age (GA) in weeks from hand length (HL) and foot length (FL) in cm

Using hand length
GA = 6.5582 + 4.9504 X HL
SE = 1.62
Using foot length
GA = 4.9381 + 4.3383  X FL
SE = 1.70

SE = standard error of the estimate



Fig 1: scatter plot of fetal hand (in cm) versus gestational age (in weeks) demonstrates a linear relationship



Fig 2: scatter plot of fetal foot (in cm) versus gestational age (in weeks) demonstrates a linear relationship

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# An Unusual Partial Hanging Using Cycle Rickshaw: A case report

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#### Abstract

A 25 year married male was found hanging, in a kneel-down position, from the hood of a cycle rickshaw with the help of a cloth, in an isolated area, next to a park. The deceased was in a financial crunch. Thorough scene investigation by a team of forensic experts, law enforcement agency and the findings during postmortem examination, ruled out the possibility of foul play. The cause of death was suicidal hanging. Though various bizarre methods of suicidal hanging are being used by people, the case presented here is unique and needs mention in forensic literature.

## Introduction

Hanging is a form of death, produced by suspending the body with a ligature round the neck, the constricting force being the weight of the body. It may be classified as complete or partial/ incomplete. When the entire body is suspended, the hanging is described as complete; incomplete hangings imply that some part of the body is still in contact with the ground.

**Reprint requests: Dr. (Lt Col) Ravi Rautji** Department of Forensic Medicine and Toxicology, AFMC, Sholapur Road, Pune, 411040, India, E-mail: rautjiravi@hotmail.com Hanging can take place with the victim in any position. In incomplete (partial) hanging cases the bodies are found in a position like standing, sitting, kneeling, reclining, prone or any other position. Mutual position of dead body parts in partial hanging is determined by many parameters, e.g. length of the rope and the height of its attachment, characteristics of surroundings and other factors like body position before hanging and binding of the extremities.

#### **Case Report**

The deceased, a young married adult, of average build was found hanging from the hood of a cycle-rickshaw with the help of a cloth. (Fig.1) The body was partially suspended with feet and knees touching the ground (kneel-down position). The deceased was a cyclerickshaw puller by occupation. On investigation he was found to be in a severe financial crunch due to a mounting loan taken by him earlier. Because of this, the individual had been under depression for the past several days. He was also a chronic alcoholic. On the fateful day he had liquor and went to an isolated area near a park with his rickshaw and committed suicide by hanging, using a cloth as a ligature in the wee hours.

## **Autopsy Findings**

The body was that of a 25-yrs old male. Rigor mortis was present all over the body. Post-mortem hypostasis was present on lower one third of forearms, hands, lower limbs, buttock and genitalia. No signs of decomposition were present. The face was congested, with tongue caught between teeth. The neck ligature had a running noose. It was present over the front of neck above thyroid cartilage. A knot mark was present on the left side at the upper part of neck.. On dissection of the neck, underlying tissues were found to be white and glistening. Thyrohyoid complex and neck vessels were intact. All internal organs were congested and petechial hemorrhages were seen on the surface of heart and lungs. No other external injuries were seen on the body of the deceased. Toxicological analysis (Qualitative) showed presence of alcohol in blood. Quantitative analysis of blood alcohol was not done. Death was due to asphyxia, as a result of ante-mortem hanging.

# Discussion

Hanging is that form of asphyxia which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body. When the weight of the entire body acts as constricting force, it is termed complete hanging, while the term partial or incomplete hanging is used when only part of the body weight acts as constricting force. Hanging is the most common mode of suicide both in males and females in all age groups. Both availability and socio-cultural acceptability determine choice of method of suicide. (Hassan R, Rautji R & Dogra

TD) Ready accessibility, its convenience and lethality, make hanging a preferred method of suicide among all age groups.

As far as place of suicide is concerned most victims commit suicide in surroundings familiar to them, mostly inside their home. (Marcikie M et al. Rautji R & Dogra TD and Mohanty S). Few people choose parks and other isolated areas for the act.

In medico-legal literature, various unusual methods of suicides by hanging are documented. Few cases of suicidal hanging within automobiles have been reported. Blanco Pampin et al. have reported a case, where the ligature material was a belt with a single twist and the point of suspension was between the window glass and the frame of the vehicle. Similar cases of hanging in an automobile are reported in literature (Durso S et. al., and Hardwicke MB et. al.). In another case, a housewife hanged herself with her left foot on a washstand and her right foot above the floor. (Terazawa K et.al.) We report a case, where a dead body was found hanging in a kneel-down position from the hood of a cycle-rickshaw. The deceased, a rickshaw puller, was a case of chronic alcoholism. He was in severe depression because of an outstanding loan against him. This led him to end his life by committing suicide. However the bizarre method chosen by him, initially presented as a suspicious death, is yet to be reported in literature.

Suicidal hanging may present in unusual circumstances, hence complete investigation of the scene of death and examination of the body in these cases is of utmost importance. In partial hanging, some body parts touching the ground which raises suspicion in manner of death. Association of bondage, masking, or gagging with partial hanging causes more doubt in manner of death. In addition to a complete medico legal autopsy, a detailed investigation of the scene, examination of the ligatures, and knowledge of the personal history of the decedent are crucial to make the decision about the manner of death.

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# Accuracy Of Balwant Rai Regression Equation in Age Estimation of Human Foetus

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### Abstract

Determination of foetal age is of significant not only in obstetrics management but also in medicolegal cases. Many a medicolegal questions especially related to fetal age are to answered by a forensic pathologist after examining a dead foetus. A study was conducted on 20 foetus of Haryana population from the Department of Forensic Medicine. Facial dimensions viz. bizygomatic width and nasion to prosthion distance were measured by verniler caliper (having resolution 0.02, instrument private Ltd. New Delhi.) and applied Balwant rai regression equation for age estimation. This was observed that using Balwant rai regression equation there was overestimation of age compared to their chronological age.

# **Key Words**

Nasion to prosthion a point distance, Bizygomatic width, Balwant rai regression equation.

### Introduction

The age determination of foetus is important as there will been enhanced punishment, in case, criminal abortion

### Reprint requests: Dr. Balwant Rai

S/o Sh. Ram Swaroop, Village Bhangu, Distt. Sirsa, P.O. Sahuwala-First, Haryana, e-mail : drbalwantraissct@rediffmailcom has been performed after 28 weeks of pregnancey<sup>1</sup>. The age of foetus may be determined from its length, weight, condition and growth of eyes, eyelashes and eye brows, growth of finger nails, location of testis, appearance of ossification centers<sup>2</sup>. Some workers like Cussenot O et al<sup>3</sup>, Guihard Costa AM<sup>4</sup>, Maydon KL et al<sup>5</sup> and Tuli et al<sup>6</sup> etc. studies craniofacial dimensions for age determination of foetus at different places. Previously, we proposed a regression equation for age estimation of foetal <sup>7</sup>. The present study has been taken up to establish accuracy of Balwant rai regression equitations for age detmrination from Bizygomatic width and nasion to prosthion distance of foetus.

# Materials and Methods

Twenty fresh dead foetus of Haryana subjects of different gestational were collected .

The fetuses were preserved in formalin solution and soft tissues were dissected and removed from the skull. Then with the help of Martin's spreading calipers the following measurements were recorded for each cases using standard landmarks :-

- A) Bizygomatic width
- B) Distance between nasion to

prosthion, and balwant rai regression equation was applied as shown below<sup>7</sup>

The data was statistically analysed (SPSS software).

Age = 3.95+0.3 bizygomatic width **Observations and Results** 

Age = 5.32+4.1 Nasion to prosthion distance

Estimated age by balwant rai regression equation and chronological age( in week) as shown in table-1

### **TABLE-1**

# Estimated age by balwant rai regression equation and chronological age( in week) in north indian population

		Age group (in weeks) calculated age		
		Distance between nasion to prosthion	Bizygomatic width	
1	9	9.2	9.1	
2	12	12.3	12.7	
3	13	13.2	13.2	
4	17	17.4	17.6	
5	11	11.5	11.6	
6	12	12.6	12.6	
7	23	23.1	23.2	
8	21	21.2	21.3	
9	13	13.4	13.3	
10	17	17.2	17.1	
11	17	17.1	17.4	
12	16	16.2	16.3	
13	32	32.1	32.2	
14	26	26.2	26.3	
15	23	23.1	23.2	
16	22	22.1	22.2	
17	24	24.1	24.2	
18	24	24.2	24.3	
19	25	25.2	25.3	
20	21	21.3	21.4	

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## Discussion

We observed that overestimation of age as compared to their chronological age (Table 1). It may be due to different in geographical, genetic and environment factors. So this equation varies from population to population, hence it should be required to study on different populations. It has been reported that correlation between craniofacial dimensions and foetal age on the fetuses of North Indian Population and deducted that the correlation coefficient of superior facial height and bizygomatic width with foetal age as 0.99 and 0.95 respectively<sup>6</sup>. In present series it was 0.83 and 0.85 respectively at 5% level of significance but in other studied that the correlation coefficient superior facial height and bizgyomatic width with foetal age as 0.85 and 0.87 respectively<sup>1</sup>.

It has been traced the craniofacial growth curves from known foetal skulls. He opined that foetal skull may provide foetal age by means of regression curves<sup>4</sup>. It has been established that superior facial height can be used as a predictor of foetal ages. They found a good correlation between superior facial height and foetal age (r=0.96) and observed that the mean growth rate was 1.3mm 1 per week upto 34 week after which it decreased to 0.5mm per wek.<sup>3</sup>

With substantially improved ultrasound imaging it is now possible to identify previously inaccessible structures, such as fetal face. The standard measurements for dating pregnancies, the biparietal diameter is virtually impossible to detain when the foetal head in facing straight up or down<sup>1</sup> the facial region, however, can identified and measured in an occiput posterior position and it is possible, therefore, that orbital diameters, superior facial height and bizygomatic width could be used to date pregnancies, in lieu of BDD.<sup>5</sup> From the present study regression equation are derived which can be used for estimation of age of the foetus from its superior facial height and also from bizygomatic width.

## Conclusion

The balwant rai regression equation calculated for both the parameters can be used for estimating the foetal age of unknown gestation period. This study will not only help obstetricans in determining gestational age but also to medicolegal experts and thus will help in administration in justice.

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