

Forensic Medicine

The first duty of a man is the seeking after and the investigation of truth-Cicero

Dr Ananda Samarasekera

History

Development of medicine can be considered as old as mankind. Law-medicine problems are found in the written records in Egypt, Babylon, India and China dating back 4000 to 3000 B.C. One of the first instances when science was used for the detection of crime was when the Greek scientist Archimedes (287-212 B.C.) found out an interesting way to detect the amount of silver used as an adulterant in a gold crown. This is known even today as "the principle of buoyancy" or the "Archimedes' principle". By cleverly applying that principle Archimedes could show that the gold crown indeed had been adulterated with silver, and consequently the goldsmith was executed. This is perhaps the first instance when forensic science was used resulting in the execution of a criminal e.

A Chinese Materi Medica of about 3000BC gives information on poisons. The Code of Hammurabi, King of Babylon (about 2200 BC), is the oldest known medico-legal code. Hippocrates (460 to 377 BC), The "Father of Western Medicine" was born and practiced in Greece, discussed the lethality of wounds. His contribution to Medical Ethics is by far his greatest in our



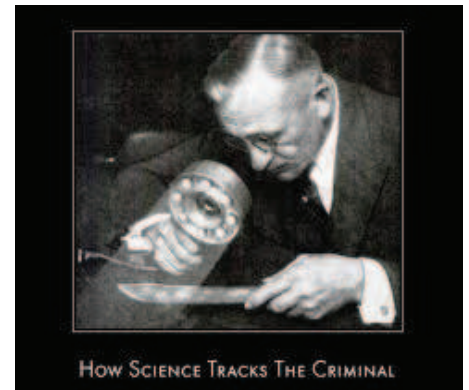
field. First medico-legal autopsy was done by Bartolomeo De Varignana in Bologna (Italy) in 1302. The first book on forensic medicine was published in 1602 by an Italian Physician, Fortunato Fedele.

Paulus Zacchias is considered the father of legal medicine as well as father of Forensic Psychiatry, and the founder of modern toxicology is Orfila from France.

In Sri Lanka forensic medicine was taught in the medical school since its inception in 1880s.

In the United Kingdom, Forensic medicine was first used in the late 1700s to determine whether a death was the result of suicide. What originated as a very simple

In Sri Lanka forensic medicine was taught in the medical school since its inception in 1880s.



inspection of the deceased person's body, has grown into the extensive medical field that we know as autopsy. Today, forensic medicine demands precision and accuracy. The modern techniques such as MRI and CT scanning are used in the examination of the dead, and virtual autopsy is replacing the conventional anatomic dissection of the body. Psychological autopsy (study and analysis of the behaviour of the deceased prior to the death by a psychologist) is used in determining the manner of death. The medical equipment and techniques used by modern forensic professionals are highly sophisticated, and to pursue a career in forensic medicine, proper and adequate training is essential .

Forensic medicine and its application

Forensic medicine is the application of medical science

Forensic Medicine

in the administration of justice that interprets and establishes the medical facts in civil or criminal lawsuits. It is also called medical jurisprudence or legal medicine. This subject mainly consists of two branches. Clinical forensic medicine, dealing with living such as a live rape victim examined for evidence of rape or other forms of sexual assaults and associated injuries, criminal abortions, evidence of pregnancy and recent delivery etc. involves knowledge of clinical methods. Similarly examination of a surviving battered child, victim of torture or cruelty and a person injured

There are finer branches in forensic medicine; Forensic psychiatry is the application of the knowledge of psychiatry for the administration of justice. Forensic toxicology deals with the medical and legal aspects



Histology laboratory

of alleged victims of sexual offences, abused children, victims of torture and examination and reporting of persons for drunkenness and drug abusers. Perhaps more significant is medical testimony in court.



Partly burnt skeletal remains at a scene

of the harmful effects of chemicals on human beings. Forensic Science is the application of the knowledge of science for the purposes of law and justice. The term includes the application of all sciences such as physics, chemistry, biology, and so on.

When merely relating observations, doctors are ordinary witnesses; interpreting facts based on medical knowledge makes them expert witnesses, required to present their evidenced based scientific and independent opinion without bias toward the side that called them. In exercising medico legal duties conflicts between medicine and law and ethics can occur, usually over medical confidentiality and consent. Forensic medicine is one of the largest and most important areas of forensic science. In practical terms, a healthcare professional who works in the field of forensic medicine aims to discover the cause of a person's death, injury, or disease. It does so in the pursuit of societal justice. Healthcare professionals who specialize in forensic medicine serve extremely important roles that require a combination of precise scientific knowledge with



Refrigerators in a mortuary

due to intentional violence or accident would be covered under clinical forensic medicine.

Forensic pathology is the other subset dealing with the dead to study, and application of the effects of violence or unnatural disease in its various forms in or on the human body, in determining the cause and manner of death in case of violence, suspicious, unexplained, unexpected, sudden and medically unattended death.

Forensic medicine which is a science of applying medical facts to legal problems has its tasks including filling out medico legal examination forms and writing medico legal reports for living related to criminal or civil cases, determining cause of death and filling certificates after post mortem examination, assessing disability for insurance claims and workmen and other forms of compensation relating to civil cases, examination and reporting

Forensic Medicine

a sincere desire to protect their communities by assisting the administration of justice.

Forensic medicine, the application of medical science to legal problems is also involved in cases concerning blood relationship, mental illness, injury, or death resulting from violence. Autopsy (examination of the dead by anatomical dissection) is often used to determine the cause of death, particularly in cases where foul play is suspected or when someone dies suddenly or due to determined cause. Post-mortem examination can determine not only the immediate agent of death (e.g. gunshot wound, poison), but may also yield important contextual information, such as how long the person has been dead, which can help tracing the killer.

Forensic medicine has also become increasingly important in cases involving rape and other forms of sexual crimes. Modern techniques use such specimens as semen,

blood, and hair samples of the criminal, found in the victim's body, which can be compared to the perpetrator's genetic makeup through a technique known as DNA profiling; this technique may also be used to establish the identity of the unknown deceased persons. This is particularly useful in mass disasters such as tsunami, landslides, explosions or transportation accidents.

The establishment of serious mental illness by a forensic psychiatrist can be used in demonstrating incompetency to stand trial, a technique which may be used in

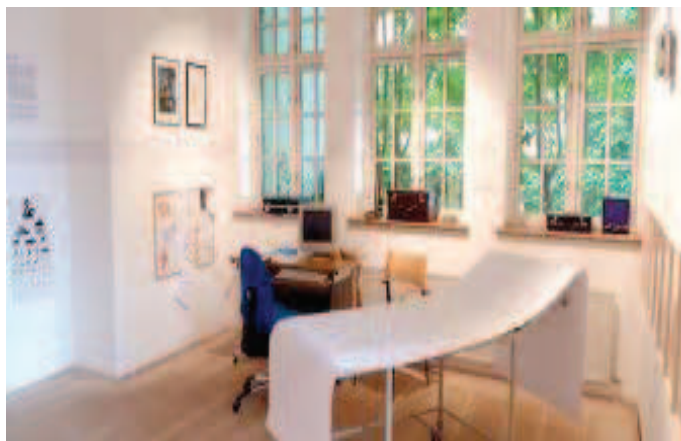
wound to head, exsanguinations, strangulation, etc.) and manner of death (homicide, murder, accident, natural, or suicide). Examination of wounds (injuries) caused by violence, accidents, self inflicted or negligence are done to determine, manner and time of causation and also to assess their seriousness and the possible effect on the body and the health of the injured. It also determines whether the injuries found in the



A modern mortuary



Cordon off scene of crime



Clinical examination room

the insanity defence, albeit infrequently. Forensic pathology is mainly concerned with determining cause of death (such as bullet

dead have been inflicted before the death (ante mortem) or after the death (post-mortem). Sometimes tissue specimens obtained at the autopsy from the dead body are processed and examined under microscope for further study (histology).

Forensic pathologists closely work with the Inquirer in to death (ISD who is also referred to as a coroner) and Magistrates when they investigate deaths (Inquest). The medical examination of dead bodies (autopsy or post mortem) is a subset of anatomical pathology. The extent of an autopsy can vary from a dissection of a single organ such as the heart or brain to a very extensive examination by complete



Autopsy- opening of neck & chest

dissection of the body. The post mortem examinations are done in a mortuary which must at least have basic facilities to do such an examination. Usually the deceased person has to be identified preferably by the next of kin.

Examination of the chest, abdomen, and head, and their contents is probably considered by most as the standard autopsy, and there are several techniques for the dissection. The autopsy begins with a complete external examination including clothes. The body measurements such as weight and height are recorded, and marks and other features such as scars and tattoos are documented. The internal examination usually begins with the creation of a Y or U-shaped incision from the neck through both shoulders joining over the sternum and continuing down to the pubic bone in the pelvis. The skin and underlying tissues are then separated to expose the rib cage and abdominal cavity.

The front of the rib cage is cut and removed to expose the neck and chest organs. This opening allows the trachea (windpipe),

thyroid gland, parathyroid glands, oesophagus, heart, thoracic aorta and lungs to be removed. Following removal of the neck and chest organs, the abdominal organs are dissected en-mass or section by section. These include the intestines, liver, gallbladder and bile duct system, pancreas, spleen,



Opening of the skull at the autopsy

adrenal glands, kidneys, ureters, urinary bladder, abdominal aorta, and reproductive organs. Sometimes limbs are dissected to do a complete muscular skeletal examination. To remove the brain, an incision is made in the top of the head from one ear to the other. The scalp is cut and separated from the underlying skull and pulled forward. The top of the skull is removed using a saw. The entire brain is then gently lifted and dissected out after incising the outer coverings of the brain. The spinal cord may also be dissected out by removing the anterior (front) or posterior (back) portion of the spinal column.

In general, pieces of all of the major organs mentioned above are further dissected and where necessary sliced into thin sections. All the organs are returned to the

body after thorough examination, and unless selected for further examination or retained for teaching, research, and diagnostic purposes with the consent of the next of kin, all are returned to the body cavity and sutured cosmetically. Autopsies have contributed to the development of medicine since at least the middle Ages. Beyond revealing causes and manner of individual deaths, autopsy is crucial to the accuracy of disease and death statistics, the education of medical students, the understanding of new and changing diseases, and the advancement of medical science. Forensic medicine is often used in civil cases.

The cause of death or injury is considered in settling insurance claims or medical malpractice suits, and blood tests often contribute to a court's decision in cases attempting to determine the paternity or maternity in disputed paternity case or child mix-up cases and immigration disputes pertaining to a child and estimation of age if chronological age is unknown or disputed.

Examination of scene of crime is an integral part of forensic investigation which is a multidisciplinary effort involving different experts in addition to forensic medical professionals. Gathering evidence and collection of contact traces (trace evidence) are the primary objectives of the scene investigation for which proper protection of the scene to preserve such evidence and prevent contamination are

Forensic Medicine

important precautions. This is the primary responsibility of the police, and to achieve the crime scene is cordoned off as early as possible, and debarred from entering any except essential scene investigators. Forensic photographers have an important role to play in recording the scene. Scene of Crime Officers (SOCO) are specially trained police officers to do a thorough search of the scene scientifically. The Pathologist sometimes has to examine the body at the scene to make important observation to interpret autopsy findings, and also to estimate the time since death and reconstruct the incident.

If the dead body is already buried, disinterment may become necessary for the purpose of criminal investigation. In such situations, on the direction of a Magistrate and with the assistance of the police, Forensic Pathologist has a major role in the exhumation procedure and recovery of the remains. Assistance of a Forensic Anthropologist (expert in skeletons) and Forensic Archaeologist (expert in digging a grave for recovery of remains) may be required when buried remains are skeletonised. Assisting the identification by scientific means of the dead victims in a mass disaster is an important function of a forensic pathologist.

Forensic medical service in Sri Lanka

Ministry of Health with assistance of university medical faculties

provide the forensic medical services to the law enforcement agencies such as police for criminal investigations and also to the prisons, to the Attorney General's department for criminal prosecutions, judiciary in criminal and civil trials involving death or bodily injury etc as an expert, mental assessment, whether a person or a motor vehicular driver has consumed drugs of abuse or alcohol, evidence of torture or cruelty in a human right cases in the Supreme Court and Human Rights Commission, medical report to labour tribunal in a workmen's compensation case, medico legal report to insurance companies pertaining to accidents and other claims involving human beings, foreign employment bureau in connection with claims related to death or bodily harm of migrant workers, and any other government agencies when medico legal reports relating to their health or death is required. Any Government Medical Officer (GMO) may be called upon by a Magistrate to conduct a medico-legal examination of a living if deem necessary. The Officer in Charge of a police station may refer a person to a GMO for medical examination and report when required. An ISD or a Magistrate may request a GMO to conduct a post-mortem examination and report on the cause of death and to give other forensic medical opinion regarding the death.

Forensic Medical specialists (Judicial Medical Officers) along



Multiple deaths in a mass disaster



Exhumation by a team

with the other non specialist GMO provide the forensic medical services in Sri Lanka. Unlike in some other countries Judicial Medical Officers in Sri Lanka conduct clinical examination of living as well as the work of a Forensic Pathologist. They are considered as experts on medical matters in law suits. When interpreting wounds they are expected to give opinion regarding the nature of the injury such as abrasion, contusion, cut, stab, burns, gunshot, fracture etc and also to state whether it has been caused by a blunt weapon such as a club, rod etc or by a sharp weapon such as a knife, broken glass piece etc. In the case of a burnt person whether it was due to fire, heat, chemical (acid, alkaline etc.), and also whether it was self inflicted or done with possible criminal intent by another etc. In a fire arm injury, whether it was from a



Ligature mark in the neck- Hanging

etc, number of shots, possible survival time and volitional activity, disability, its manner of infliction and whether the findings are consistent with the alleged incident. Courts tend to rely more on scientific evidence as they are independent and unbiased.

- Manner of death.
- Possible circumstances of death.
- Is the medical evidence corroborative or refute other evidence?

Two persons, the lover of the deceased and his new partner were charged for murder. At the trial at bar the lover was convicted and the partner was acquitted. The judgment was upheld by the Supreme Court.



Autopsy instruments

Case illustration:

1. An ex army woman soldier was missing for nearly months. An exhumation was done months later at the compound of her lover's house on the information obtained by police who were suspects. Lots of valuable forensic evidence was collected during the exhumation. They corroborated with the evidence of other witnesses at the trial body of female dressed in cloths with ear studs was disinterred.

2. A middle aged foreigner, male, was found dead in a pool of blood in the adjoining bath room of the room he lived in the hotel. His dead body was removed by the police to the mortuary. A deep cut throat injury was found at the autopsy and the death was due to hemorrhage. Subsequent visit to the scene, which had not been much disturbed, showed evidence to conclude the possible manner of death. Forensic investigation of the scene and autopsy findings confirmed that it was a suicidal cut throat injury.

shotgun or rifled firearm, number of shots received, direction, distance, lethality of the injuries, relative positions of the injured and the shooter, volitional activities which may or may not have been performed by the injured such as running, talking fighting back etc after sustaining injuries and whether the injuries are suggestive of self infliction or caused by another with possible criminal intent, friendly hand or due to an accident.

Unlike ordinary lay (eye) witnesses forensic medical specialists are called upon to give an opinion in a court of law based on relevant facts in a criminal or civil case. Such opinion includes seriousness or lethality of a wound, nature of the weapon, direction of the blow, assault, shooting, stabbing

The body that had undergone mummification, safonification and decomposition was recovered. An autopsy was done to find answers to medico legal issues.

- Identity of the deceased.
- Place of death
- How and when the body came to lie at the site of recovery?
- Cause of death.

Dr Ananda Samarasekera
(MBBS, MSc. MD)
Chief Judicial Medical Officer
Institute of Legal Medicine & Toxicology